TM 8-233

WAR DEPARTMENT TECHNICAL MANUAL

HANDBOOK FOR PHARMACY TECHNICIANS

WAR DEPARTMENT • NOVEMBER 1945

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This manual supersedes TM 8-233, Methods for Pharmacy Technicians, 13 October 1941, including C 1, 16 June 1942, and C 2, 28 February 1944.

HANDBOOK FOR PHARMACY TECHNICIANS

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TM 8–233, Handbook for Pharmacy Technicians, is published for the information and guidance of all concerned.

[AG 300.7 (18 Dec 44)]

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Chief of Staff

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TECHNICAL MANUAL

HANDBOOK FOR PHARMACY TECHNICIANS

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DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *27 May 1949*

TM 8-233, 20 November 1945, is changed as follows:

1. Paragraph 2*b* is changed by adding the following sentence to the second paragraph: **"The United States Pharmacopoeia (U. S. P.) 13, was published and became official 1 April 1947."**

2. Paragraph 13*b*, Table of approximate equivalents, is changed by deleting line 8 and substituting: "1 apothecaries' ounce H_2O=1.052 fluidounces."

3. So much of the authentication page as reads "6 September 1945" is changed to read **"20 November 1945".**

[AG 300.7 (6 May 49)]

BY ORDER OF THE ACTING SECRETARY OF THE ARMY:

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Chief of Staff, United States Army

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This manual supersedes TM 8-233, Methods for Pharmacy Technicians, 13 October 1941, including C 1, 16 June 1942, and C 2, 28 February 1944.

CHAPTER 1

GENERAL

Section I. GENERAL

1. SCOPE. a. This manual is intended as a ready reference for the pharmacist and for enlisted pharmacy technicians who will work in a pharmacy under the supervision of a commissioned officer. It is not intended to replace, but only to supplement, the standard reference books which are available in all permanent and in many temporary installations.

b. The drugs included in this manual are in most instances taken from the selected list in the Medical Department Supply Catalog.

2. DEFINITIONS. a. (1) *Pharmacy* is a profession which applies a fundamental knowledge of certain sciences, including those mentioned below:

Chemistry investigates the composition of all substances, together with the combinations and decompositions resulting from their action upon one another under the influence of chemical force.

Physics deals with matter and its properties so far as they are intimately associated with the transformations of energy. Physics, therefore, includes dynamics and the branches of science that deal with light, heat, electricity, magnetism, and sound.

Zoology treats of the natural history of all animals, their structure, physiology, classification, descent, and habits.

Botany treats of the structure of plants, the functions of their parts, their places of growth, and their classifications.

Mineralogy treats of the properties of mineral substances and characterizes, distinguishes, and classifies them according to their properties.

Biology is the science of living organisms, their morphology, physiology, origin or development, and distribution.

Physiology may be considered as that branch of biology which treats of the functions of the living organisms, plant or animal, correlates these functions as to cause and effect, and traces out their dependence upon the physical states of the organs by which these functions are exercised.

Bacteriology treats of microorganisms.

Pharmacology is the science of drugs, usually interpreted as being the actions of drugs on the body, including materia medica, pharmacodynamics, and therapeutics.

Materia medica treats of the origin, composition, and properties of medicinal agents.

Pharmacodynamics deals with the actions of drugs on undiseased living organisms.

Therapeutics is a consideration of the actions of drugs in the treatment of disease.

Toxicology is the scientific study of poisons, their actions, their detection, and the treatment of the conditions produced by them.

Posology is the study of doses of drugs.

Pharmacognosy is the study of crude drugs, their source, origins, parts used, active constituents, collection and storage.

(2) Pharmacy in the Army has for its primary object the service which it can render in safeguarding the preparation, compounding, and dispensing of drugs.

(3) The term "drug" (as defined in the Federal Food, Drug, and Cosmetic Act) means "(1) articles recognized in the official United States Pharmacopoeia, official Homeopathic Pharmacopoeia of the United States, or official National Formulary, or any supplement to any of them; and (2) articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in man or animals, and (3) articles (other than food) intended to affect the structure or any function of the body of man or animal; and (4) articles intended for use as a component of any articles specified in clause (1), (2), or (3); but does not include devices or their component parts, or accessories."

b. The United States Pharmacopoeia (U.S.P.). The Pharmacopoeia is issued and revised by the United States Pharmacopoeial Convention which is composed of delegates representing state medical and pharmaceutical associations, medical and pharmaceutical colleges as well as certain allied professions and sciences. The object of the Pharmacopoeia is to provide standards for drugs and medicines of therapeutic usefulness or pharmaceutical necessity, sufficiently used in medical practice within the United States or its possessions; to lay down tests for the identity, quality, and purity of these; to insure, so far as practicable, uniformity in physical properties and active constituents.

The Pharmacopoeia was first published in 1820 and has been revised every ten years since that time. The Convention for the Eleventh Revision of the United States Pharmacopoeia (1940) decided that two revisions would be published in the next decade in order to keep pace with the rapid progress in the medical sciences and that interim revision announcements or supplements would be published in the meantime. This program of "continuous revision" is of particular significance in times of national emergency since shortages of critical materials frequently necessitate variations in the official standards.

The names of various substances are indicated in the Pharmacopoeia as follows:

(1) *Official Latin title. Example: ELIXIR AROMATICUM.*

(2) *Official English title. Example:* AROMATIC ELIXIR.

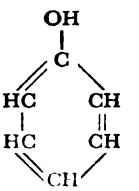
(3) *Abbreviated title. Example:* ELIX. AROM.

(4) *Synonym. Example:* SIMPLE ELIXIR.

(5) *Botanical name* (in the case of plants). *Example:* ATROPA BELLADONNA.

(6) *Symbolic formula* (in the case of chemicals). *Example:* $BaSO_4$.

(7) *Structural formula* (in the case of organic chemicals wherever generally accepted by chemists). *Example:* PHENOL.



(8) *Official definition.* In order that no question shall arise as to the exact meaning of the official Latin title, or any other name by which an official substance is known, it is necessary to state explicitly what kind or variety

of the substance should be used. Example: *FERRUM*. Elementary Iron (Fe) in the form of fine, bright wire, filings or powder.

(9) *Purity rubric.* This term indicates the paragraph which limits the quantity of innocuous impurities in chemicals, drugs, and other substances, by stating in terms of percentage the amount of pure substance that must be present. Example: *SODII SALICYLAS*, Sodium Salicylate, when dried to constant weight at 100°C., contains not less than 99.5 percent of C_6H_4. OH. COONa.

(10) *Official description.* Immediately following the official definition of the substances there will be noticed in the Pharmacopoeia, in smaller type, what has been termed the official description. This usually consists, for drugs, of a concise statement of their physical characteristics, when entire, and also, in most instances, the structure of the same drug when sectioned or powdered. In the chemicals the official definition usually includes the symbolic formula, the "purity rubric," and the official description, which are printed in smaller type, exactly as in the case of vegetable drugs. To the descriptions of the chemical drugs are usually added the solubility statements.

(11) *Tests for identity and purity.* In the U.S.P. the tests which establish the identity of a chemical and those which insure the Pharmacopoeial minimum degree of purity are grouped under the appropriate headings.

(12) *Assay.* Chemicals, preparations, and certain crude drugs have assays included in their monographs which are intended to insure their contents to be in accord with the "purity rubric."

(13) *Storage.* Certain official drugs and preparations of the Pharmacopoeia have storage specifications set forth designed to maintain their medicinal activity for a maximum period of time.

(14) *Preparations.* Where a pharmacopoeial substance is an item in the manufacture of official pharmaceuticals, these preparations are listed.

(15) *Doses.* The doses are given in both the metric and apothecaries' systems. The figures are neither interchangeable, nor are they to be considered as exact equivalents. Under "Average Dose" is stated the dose which may be expected ordinarily to produce the therapeutic effect for which the drug or preparation is most commonly employed. The doses, unless otherwise indicated, are intended to mean oral doses when administered to adults.

c. The *National Formulary* (N.F.) is revised and issued by the American Pharmaceutical Association through its Committee on National Formulary. The purpose of the National Formulary is to supply definite formulas for preparations that are sufficiently used in medical practice within the United States, or its possessions, and for which formulas are not included in the Pharmacopoeia of the United States; and to provide standards and tests for the identity, quality, and purity of the ingredients used in these formulas, and for such other drugs as are frequently called for in the pharmacies of the United States, for which standards are not provided in the U.S. Pharmacopoeia, so that uniformity in the physical properties and therapeutic action of these preparations and medicinal materials will be assured. The National Formulary is similar to the Pharmacopoeia in arrangement and is intended to be revised and to appear at the same time as the revisions of the Pharmacopoeia.

d. *New and Nonofficial Remedies* (N.N.R.) is a book published by the American Medical Association through its Council on Pharmacy and Chemistry. It lists such unofficial representatives of the newer materia medica, chiefly synthetic or biological, as have been accepted under the rules of the Council.

e. *A dispensatory* is an unofficial commentary on drugs, giving their physical, medical, and pharmaceutical history, with their doses, properties, and uses.

Section II. ADMINISTRATION AND SUPPLY

3. GENERAL. Pharmacies, like all other Army installations, are governed by Army Regulations, amplified or expanded by local regulations and orders promulgated by the station commander and the surgeon. Each pharmacy officer and technician should therefore familiarize himself with the provisions of AR 40–590, 40–1705, TM 38–403, 38–220, and all local regulations pertinent to the pharmacy.

4. SUPPLY. One of the most important administrative functions connected with the pharmacy is the maintaining of adequate medicinals and equipment necessary to their proper dispensing. The maintenance of adequate supplies in the medical supply is the responsibility of the medical supply officer and the pharmacy officer should maintain close liaison with this department with reference to pharmacy supplies. He should assist the medical supply officer in determining the levels of each item required for the pharmacy, basing the requirements on past issue experience and anticipated needs. The medical supply officer will have available all correct supply publications for reference.

a. Army Service Forces Medical Supply Catalog. This Catalog lists the items that are stored and issued by the Medical Department. It establishes the official item designation for use in the preparation of requisitions, records, reports, and correspondence concerning medical supplies.

b. Nonstandard articles. The addition of many new standard items to the Medical Supply Catalog has decreased the necessity for the use of nonstandard items. The items now listed include those generally recognized as essential to medical practice and recourse to nonstandard items will rarely be necessary. Medical officers may find that a compound which they frequently prescribed in civilian practice is not included in the Catalog. However, items have been included which serve the same purpose. Standard or nonstandard supplies required in emergency to save life or prevent suffering may be procured and vouchered to distribution depots under the provisions of AR 40–1705.

c. Requisitioning from the medical supply officer. (1) Items appearing in the Army Service Forces Medical Supply Catalog will be requisitioned by the pharmacy officer from the medical supply officer on WD AGO Form 446 (Property Issue Slip). Separate requisitions will be prepared for expendable and nonexpendable items. Examples of requisitions are shown in Med. 1, Introduction to Army Service Forces Medical Supply Catalog.

(2) *Nonstandard items not carried in stock at the medical supply.* Items which are nonstandard and which are obtained by local purchase must be supported by certificates showing their necessity. This may be on the requisition itself or accompany it in a separate letter of request.

d. Requisitions by the medical supply officer. (1) The source of supply beyond the medical supply officer is the medical distribution depot. Monthly requisitions are submitted by the medical supply officer to the distribution depot to replenish station stocks.

(2) In addition, the medical supply officer may purchase articles necessary to prevent suffering or distress among the sick and injured from Medical Department funds as outlined in AR 40–1705.

5. ADMINISTRATION. The administration of the pharmacy is carried out by the pharmacy officer under the general supervision of the surgeon and the station commander.

a. Pharmacy officer. This officer is in charge of the pharmacy and is responsible for carrying on the work of the drugroom, for general policy, property responsibility, and the handling, storing, and dispensing of narcotics, poisons, and alcohol.

b. Records. (1) In time of peace and, so far as practicable, in time of war, all prescriptions will be written in the metric system. They will be placed on file in three separate files (each carrying a different series of numbers) as follows:

(*a*) Prescriptions for alcohol or alcoholic liquors and for medicines containing opium or any of the salts, derivatives, or preparations of opium or coca leaves.

(*b*) Prescriptions for civilians which do not include articles of the preceding class.

(*c*) All other prescriptions.

(2) Prescription files will be subject to inspection by inspectors and station commanders at all times.

(3) With reference to b (1) (*a*) above, a record will be kept of the pharmacy receipts and expenditures of each article specified therein. These items are shown with a (6) in the "Notes" column of the Army Service Forces Medical Supply Catalog. This record is commonly called the Narcotic Register and should be made on WD AGO Form 421, adapted as may be necessary for the purpose, filed in a looseleaf binder as listed in the Army Service Forces Medical Supply Catalog. A separate slip will be kept for each form in which liquor or drug is supplied, as, "Morphine sulfate, 1 oz.," or "Morphine sulfate, 20 (½ gr. hypo. tablets)." The date of receipt thereof from the medical supply will be noted in the left-hand column and the amount in the proper unit, in the debit column. The expenditures will be noted by entering the prescription number in the left-hand column and the amount expended in compounding the prescription in the credit column. At least once a month, the slips will be balanced and the quantities remaining on hand will be verified by a Medical Department officer and the facts with the date of verification noted over his signature.

(4) With reference to b (1) (*b*) and (*c*) above, the methods of filing prescriptions may vary with the availability of materials with which permanent records can be made. Pasting the prescriptions in a large filing book has been used extensively, and the book is listed in the Army Service Forces Medical Supply Catalog as, "Book, Prescription Filing," for this purpose. This method, however, proves time consuming and may be deviated from in any other practicable method.

CHAPTER 2

PHARMACEUTICAL MATHEMATICS

Section I. METROLOGY

6. GENERAL. Metrology is the study of measurement as applied to extension, volume, and weight. The metric system of measure is employed in the Pharmacopoeia, the National Formulary, and in New and Nonofficial Remedies. In the general practice of pharmacy, the English linear system is used in measuring extension; the apothecaries' system in measuring weight and volume and in the writing and filling of prescriptions; and the avoirdupois system in measuring weight in commercial transactions including the purchase and sale of drugs and medical supplies.

The use of the metric system of measurement was legalized in the United States in 1866 and its use in all medical requirements including the writing and filling of prescriptions was made obligatory in the Medical Department of the U. S. Army in 1894. However, all of the systems mentioned are employed in the Supply Catalogs of the Medical Department.

7. METRIC SYSTEM. a. General. The metric system is decimal and its primary units of volume and weight are derived from the primary unit of extension, the meter, which simplifies the conversion of values as compared to the other systems mentioned above.

Primary unit of length, the *meter*, may be defined as 1/40,000,000 of the earth's circumference, measured across the poles or as 1/10,000,000 of the earth's quadrant.

Primary unit of volume, the *liter*, may be defined as the cube of one-tenth of a meter (decimeter), or as the volume occupied by a kilogram of water at its greatest density.

Primary unit of weight, the *gram*, is the weight of a cubic 1/100 meter (cubic centimeter) of water at its greatest density, and weighed *in vacuo*.

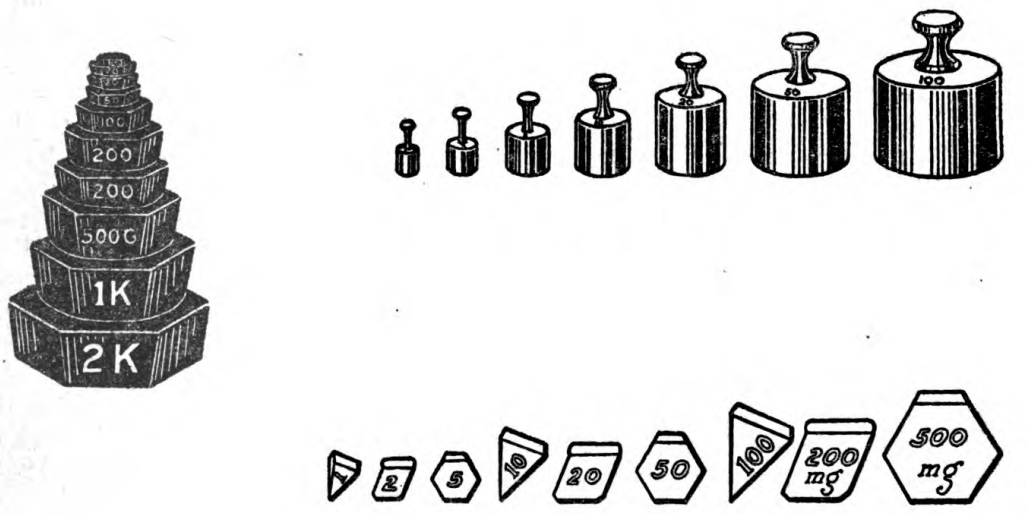


Figure 1. Metric weights.

b. Metric tables. To simplify measuring, the primary unit of each branch was subdivided into 1000, 100, and 10 secondary parts; secondary units larger than the primary units were established by taking the primary units in multiples of 10, 100, and 1000. *All secondary units differ from one another by some power of 10.*

Fractional parts of the primary units are expressed by adding the Latin prefixes: *milli* (1/1000), *centi* (1/100), and *deci* (1/10) to the names of the primary unit itself.

Denominations larger than the primary units are expressed by adding the Greek prefixes: *deka* (10), *hecto* (100), and *kilo* (1000), to the name of the primary unit.

Metric table of length	Abbreviated form
10 millimeters = 1 centimeter	10 mm = 1 cm
10 centimeters = 1 decimeter	10 cm = 1 dm
10 decimeters = 1 meter	10 dm = 1 m
10 meters = 1 dekameter	10 m = 1 Dm
10 dekameters = 1 hectometer	10 Dm = 1 Hm
10 hectometers = 1 kilometer	10 Hm = 1 Km

By replacing the primary unit of length with the primary unit of volume or weight, the appropriate table will be derived. The technician may more readily visualize these tables if they are compared to our monetary system which is also a system of decimal progression. Thus—

10 mills = 1 cent = $0.01	10 mm = 1 cm = 0.01 m
10 cents = 1 dime = $0.10	10 cm = 1 dm = 0.10 m
10 dimes = 1 dollar = $1.00	10 dm = 1 m = 1.00 m

Abbreviations of the divisions and multiplications consist of the first letter of the prefix and the first letter of the unit except in the case of the gram which is always abbreviated Gm to differentiate it clearly from the abbreviation for grain which is gr. The first letter of the abbreviation should be capitalized in the case of multiplications to differentiate them from the abbreviations of divisions; thus, dm for decimeter and Dm for dekameter.

Metric table of weight	Abbreviated form
1000 micrograms = 1 milligram	1000 μg = 1 mg
10 milligrams = 1 centigram	10 mg = 1 cg
10 centigrams = 1 decigram	10 cg = 1 dg
10 decigrams = 1 gram	10 dg = 1 Gm
1000 grams = 1 kilogram	1000 Gm = 1 Kg

c. Reading the metric system. The reading of metric quantities is similar in many respects to the reading of sums of money. The following analagous readings may serve to enlighten the technician:

$0.30 may be read as—
- Three dimes.
- Thirty cents.
- Three hundred mills.

0.3 meter may be read as—
- Three decimeters.
- Thirty centimeters.
- Three hundred millimeters.

0.3 gram may be read as—
Three decigrams.
Thirty centigrams.
Three hundred milligrams.

0.45 meter may be read as—
4.5 decimeters.
45 centimeters.
450 millimeters.

0.78 liter may be read as—
7.8 deciliters.
78 centiliters.
780 milliliters.

2.75 grams may be read as—
2.75 grams.
27.5 decigrams.
275 centigrams.
2,750 milligrams.

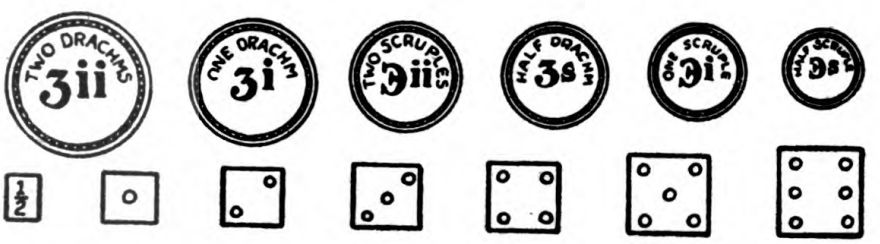
Note. Since the liter is the volume of a cubic decimeter (10 dm)^3, the thousandth part of a liter also may be called a cubic centimeter (abbr. cc). Sometimes the word *milliliter* is shortened to *mil*. Therefore, milliliter, mil, cubic centimeter, and cc all refer to 1/1000 of a liter.

8. ENGLISH LINEAR MEASURE. Length and area are commonly measured in the English linear measure. The unit of the system is the inch and divisions of the unit are measured in common fractions.

Example:

12 inches = 1 ft.
3 feet = 1 yd.

9. APOTHECARIES' FLUID MEASURE. The unit of the system is the minim and divisions of the unit are expressed in common fractions. In writing prescriptions in the apothecaries' system, the various denominations are designated by symbols or abbreviations followed by the amount indicated in Roman numerals. For example: ♏ = minim; fl.ʒ = fluid dram; fl.ȝ = fluid ounce; 0 = pint.



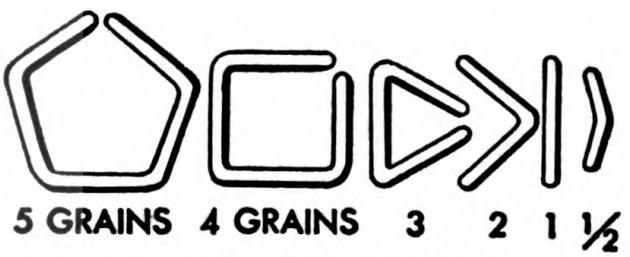


Figure 2. Apothecaries' weights.

10. APOTHECARIES' SYSTEM. This system of weight is now employed only in the writing and filling of prescriptions. The unit is the grain and divisions of the unit are expressed in common fractions.

Table of the apothecaries' fluid system.

60 minims = 1 fluidram.
8 fluidrams = 1 fluidounce = 480 minims.
16 fluidounces = 1 pint = 7,680 minims.
2 pints = 1 quart.
4 quarts = 1 gallon.

In writing prescriptions in the apothecaries' system, the various denominations are designated by certain symbols or abbreviations, followed by the amount indicated in Roman numerals. For example: gr = grains; ℈ = scruples; ʒ = drams; ℥ = ounces.

Table of the apothecaries' system of weight.

20 grains (gr.) = 1 scruple.
3 scruples = 1 dram = 60 grains.
8 drams = 1 ounce = 480 grains.
12 ounces = 1 pound = 5,760 grains.

11. AVOIRDUPOIS WEIGHT. Avoirdupois weight is used entirely for commercial transactions. The unit is the grain and divisions of the unit are expressed in common fractions. In the table of avoirdupois weight:

437.5 grains = 1 ounce (oz.).
16 ounces = 1 pound (lb.) = 7,000 grains.

12. APPROXIMATE MEASURES.

1 tumblerful = about 8 fluidounces, or 240 cc.
1 teacupful = about 4 fluidounces, or 120 cc.
1 wineglassful = about 2 fluidounces, or 60 cc.
1 tablespoonful = about 4 fluidrams, or 16 cc.
1 dessertspoonful = about 2 fluidrams, or 8 cc.
1 teaspoonful = about 1 fluidram, or 4 cc.

One drop (L., gutta, pl., guttae, usually abbreviated gtt.) is often considered as equal to about one minim, but the size of drops varies with the character of the liquid, the temperature, and the surface from which it is dropped. Therefore, one drop should not be considered to equal one minim.

Note also that the modern standard teaspoonful is equivalent to about 5 cc, or more than a fluidram. This fact is true of other such household measuring devices.

13. RELATIONSHIP OF THE SYSTEMS. a. General. The pharmacy technician must know not only the various systems of weights and measures, but he must be able to convert weights and measures from one system to those of another; in other words, he must master the relationships of the systems. The conversion of weights and measures of one system to those of another is done by means of equivalents, presented below. The derivation of these equivalents as follows will enable the technician to arrive at an equivalent in several ways should he fail to remember a particular one.

(1) *Metric and linear measure.*

Given: 1 m = 39.37 inches. 1 m = 100 cm (metric table).

Therefore: $\frac{100}{39.37} = 2.54$ cm in 1 inch.

Since there are 10 mm in 1 cm, 2.54 cm contains 2.54×10 or 25.4 mm.

Therefore: 1 inch = 25.4 mm.

(2) *Metric and apothecary fluid measures.*

Given: 1 liter = 1,000 cc. If a liter of any liquid is poured into apothecary graduates, it will be found that the liter of liquid measures 16,230 ♏'s.

Therefore: $\frac{16,230}{1,000} = 16.23$ ♏'s in 1 cc.

Given: 1 cc = 16.23 ♏'s. As an apothecary fluidounce contains 480 ♏'s, we have—

$$\frac{480}{16.23} = 29.57 \text{ cc in 1 fluidounce}$$

Given: 1 fluidounce = 29.57 cc and 1 liter = 1,000 cc.

Therefore: $\frac{1,000}{29.57} = 33.8$ fluidounces in 1 liter.

Given: 1 pint = 16 fluidounces and 29.57 cc = 1 fluidounce.

Therefore: $16 \times 29.57 = 473$ cc = 1 pint.

Given: 473 cc = 1 pint and 1,000 cc = 1 liter.

Therefore: $\frac{1,000}{473} = 2.11$ pints = 1 liter.

Given: 1 cc = 16.23 minims.

Therefore: $\frac{1}{16.23} = 0.06$ cc = 1 ♏.

(3) *Metric and apothecary weights.* If a gram weight is placed on a delicate balance, it will weigh 15.432 grains.

Therefore: 1 Gm = 15.432 grains.

Given: 480 grains and 1 Gm = 15.432 grains.

Therefore: $\frac{480}{15.432} = 31.1$ Gm = ℥ (apoth. ounce).

Given: 1 Gm = 15.432 grains.

Therefore: $\frac{1}{15.432} = 0.0648$ Gm = 1 grain.

Since 0.0648 Gm is 64.8 milligrams, one grain contains 64.8 milligrams; however, in work involving the calculation of doses, the figure is rounded to 65 mg = 1 grain to facilitate calculations.

The following equivalents are obtained by weighing the respective quantities of water:

1 fluidounce of water = 455 grains.
1 minim of water = 0.95 grains.
1 pint of water = 1.04 pounds, avoirdupois.
1 gallon of water = 8.33 pounds, avoirdupois.

(4) *Metric and avoirdupois equivalents.* As the apothecary and avoirdupois grains are identical, the avoirdupois grain is likewise equivalent to 0.0648 Gm or 64.8 mg.

Given: 1 oz = 437.5 grains and 1 Gm = 15.432 grains.

Therefore: $\frac{437.5}{15.432} = 28.35$ Gm = 1 oz or ounce.

Given: 16 oz = 1 lb and 28.35 Gm = 1 oz.

Therefore: $16 \times 28.35 = 454$ Gm = 1 lb.

Given: 1,000 Gm = 1 Kg and 454 Gm = 1 lb.

Therefore: $\frac{1,000}{454} = 2.2$ lb = 1 Kg.

A careful study of the derivation of equivalents will indicate their uses. To convert 12 pints to cc, multiply 12 by the number of cubic centimeters in 1 pint (473). Likewise, if 2,345 cc are to be converted to pints, the 2,345 cc are divided by 473 or divide 2,345 cc by 1,000 (simply by moving the decimal point three places to the left) thus converting 2,345 cc to liters and then multiply the result by 2.11 (the number of pints in a liter).

b. Table of approximate equivalents.

1 gram = 15.432 grains.
1 cubic centimeter = 16.23 minims.
1 grain = 64.8 milligrams.
1 meter = 39.37 inches.
1 liter = 33.8 fluidounces or 2.11 pints.
1 inch = 25.4 millimeters or 2.54 centimeters.
1 apothecaries' ounce = 31.1 grams.
1 apothecaries' ounce = 2.052 fluidounces.
1 avoirdupois ounce = 28.35 grams.
1 apothecaries' fluidounce = 29.57 cubic centimeters.
1 pint = 473 cubic centimeters.
1 minim = 0.06 cubic centimeters.
1 gallon = 3.785 liters or 3,785 cubic centimeters.
1 pound (lb) = 454 grams.
1 kilogram = 2.2 pounds.

c. Table of water equivalents.

1 fluidounce of water (fl℥) = 455 grains.
1 minim of water = 0.95 grains.
1 pint of water = 1.04 pounds (av.) or 473 grams.
1 gallon of water = 8.33 pounds (av.) or 3.785 kilograms.

14. ADDITION, SUBTRACTION, MULTIPLICATION, AND DIVISION OF WEIGHTS AND MEASURES. a. Metric system. To simplify procedures, express all lengths in meters, all volumes in cubic centimeters, all weights in grams.

Addition. Add 3 Kg, 33 Gm, 3 cg, 433 mg.

Solution:

3 Kg =	3 × 1,000 =	3,000	Gm
33 Gm =		33	Gm
3 cg =	3 ÷ 100 =	.03	Gm
433 mg =	433 ÷ 1,000 =	.433	Gm
		3,033.463	Gm

Subtraction. Subtract 285 cubic centimeters from 5 liters.

Solution: 5 liters = 5,000 cc

$$\begin{array}{r} 5{,}000 \text{ cc} \\ 285 \text{ cc} \\ \hline 4{,}715 \text{ cc} \end{array}$$

Multiplication. Multiply 325 mg by 5.

Solution: 325 mg × 5 = 1,625 mg
1,625 mg ÷ 1,000 = 1.625 Gm

b. English system. To simplify procedures express all units in the smallest unit involved.

(1) *Addition, apothecaries' weight.* Add 5 pounds, 4 ounces, 36 drams, 720 grains.

Solution:

5 lb =	5 × 5,760 gr =	28,800 gr
4 oz =	4 × 480 gr =	1,920 gr
36 dr =	36 × 60 gr =	2,160 gr
720 gr =		720 gr
		33,600 gr

(2) *Addition, avoirdupois weight.* Add 10 pounds, 14 ounces, ¼ ounce, 27 grains.

Solution:

10 lb =	10 × 7,000 =	70,000 gr
14 oz =	14 × 437.5 =	6,125 gr
¼ oz =	¼ × 437.5 =	109.37 gr
27 gr =		27 gr
		76,261.37 gr

(3) *Addition, fluid measure.* To add fluid measure, the same principle is involved as in the addition of solid measure. Add 14 gallons, 7 pints, 6 fluidounces.

Solution:

14 gal	= 14 × 128 fl oz =	1,798 fl oz
7 pt	= 7 × 16 fl oz =	112 fl oz
6 fl oz =		6 fl oz
		1,916 fl oz

(4) *Subtraction, multiplication, and division.* The same principle is involved as in addition. Reduce weights or measures to smallest unit involved and proceed. When final answer is obtained it may be changed back to the next larger unit. *Example:* 600 apothecaries' grains would be changed to 600 ÷ 480 (gr in 1 oz) = 1 oz and 120 gr, or 1 oz and 2 dr.

15. INSTRUMENTS FOR MEASURING. a. Balances. These are instruments for determining the relative weight of substances. If accurate results are to be obtained the balance should be correctly constructed, skillfully used, and carefully protected from injury. Pharmaceutical balances used in military pharmacies may be classified as follows:

(1) *Single beam, equal arm balance.* In the construction of this balance, a beam is suspended on a knife edge, which divides it into equal arms, and knife edges are placed at each end of the beam on the same plane and at exactly equal distances from the point of suspension to support the pans which carry the substances to be weighed.

(2) *Torsion balance.* The chief differences between the torsion and other balances lies in the entire absence of knife edges and the location of the center of gravity above the fulcrum or point of rotation. The knife edges have been replaced by three steel bands or springs tightly stretched over the edges of the three frames supporting the beam. The center of the beam is fastened to the center of the strained band or spring and at right angles to it, under which condition, by the elasticity or torsion of the band or spring, it will vibrate exactly as the ordinary beam balanced on knife edges; the pans rest upon similar torsion bands or springs at the ends of the beam in the same manner as the central fulcrum of the beam.

(3) *Care of a balance.* The position chosen for the balance should be upon a level and firm counter, desk, or table, where it will be subjected to little risk of injury from dampness, dust, or corrosive vapors, and where the knife edges will not be liable to become dulled by jarring or other vibrations. The balance and scale pans should not be polished with abra-

sive substances but should be cleaned with a soft cloth. *The beam should never be left in oscillating position when the balance is not being used.* Weights should be put on and replaced with tweezers. The same care should be exercised in cleaning weights as the balance and scale pans. The first step in weighing is to see that the balance is in balance; then place a piece of pan paper in each pan and again see that the balance is in balance. Put the weights in the right-hand pan and carefully place enough of the substance in the left-hand pan to balance the weights exactly. After removing the substance, check the weights to see that the amount is correct. In weighing substances that injure the scale pans by their chemical action, always use watch glasses or wax paper. Do not exchange one scale pan for the other, as they are balanced in their respective positions. Do not overload the balance in excess of indicated capacity as marked on the balance.

c. Graduates. Graduates are vessels for measuring the volume of liquids and are made of glass. They are either conical or cylindrical in shape and are graduated in the metric or the apothecaries' system, or both. Cylindrical graduates are preferred. The bottom of the meniscus is used as the level in measuring.

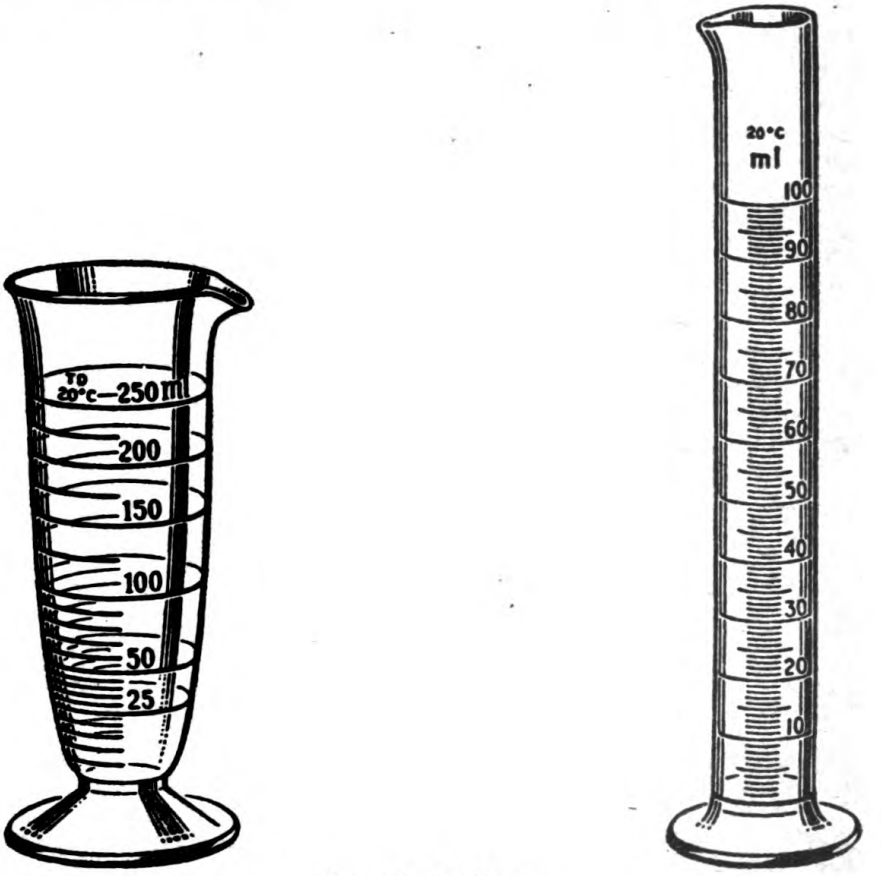


Figure 3. Graduates.

A minim graduate is not reliable for measuring minute quantities because it retains a large amount of liquid by capillarity. Therefore a pipette should be used. Pipettes are glass tubes with a constricted point and graduated on the side. They are used by applying suction to the upper end and holding the liquid in the tube by placing the finger on the upper end while reading off the contents.

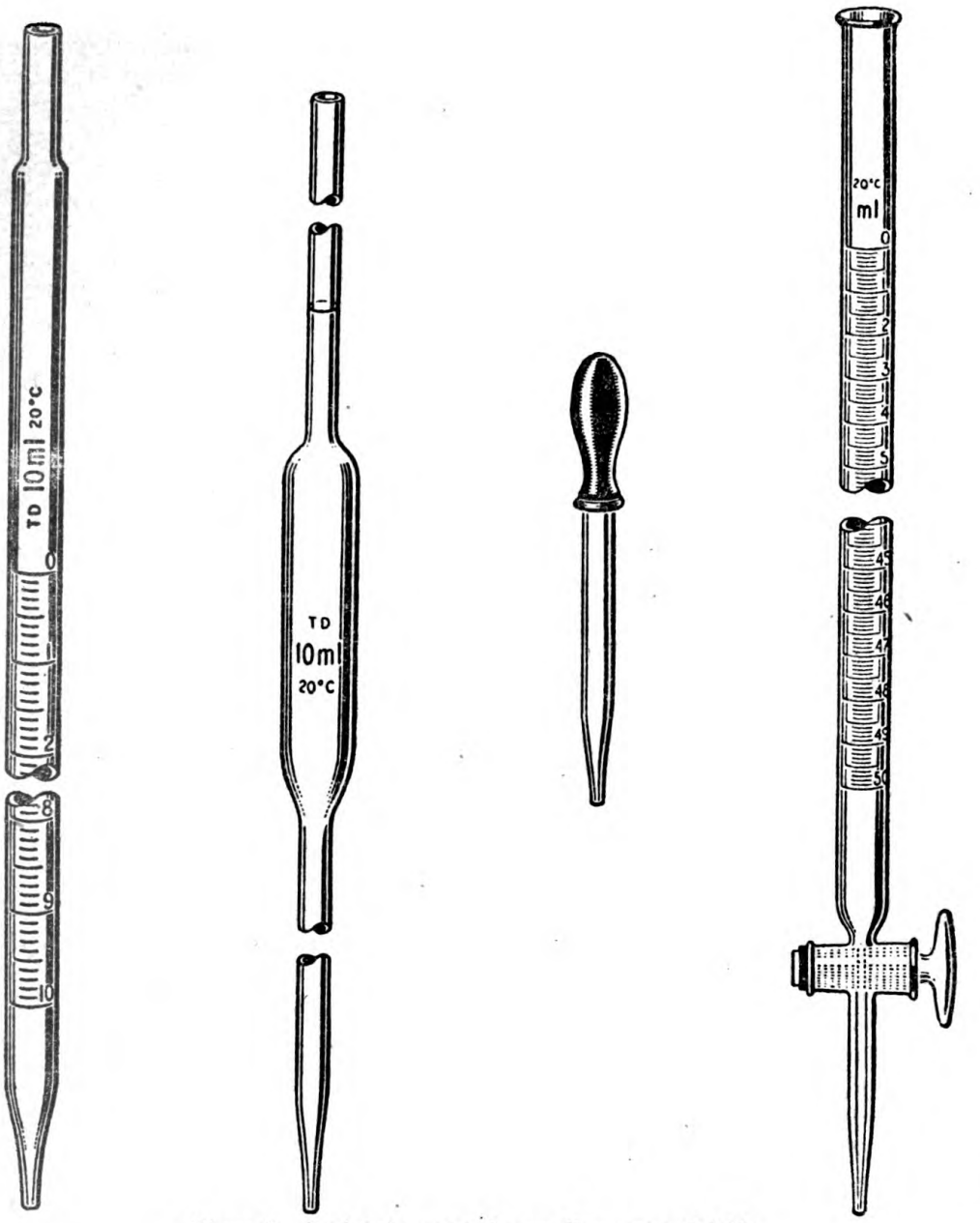


Figure 4. Devices for measuring small amounts of fluids.

Section II. SPECIFIC GRAVITY

16. DEFINITION. *Specific gravity*, abbreviated sp. gr., indicates the relation in weight, expressed decimally, between equal volumes of two substances, one of which is a standard, determined at 25° C. and at normal barometric pressure. Distilled water is the standard for liquids and solids, and atmospheric air or hydrogen is the standard for gases. The specific gravity of the standards is expressed by unity, 1.000.

17. SPECIFIC GRAVITY OF LIQUIDS. The determination of the specific gravity of liquids is far more frequently required than is that of solids, and specific gravity flasks (pycnometers), hydrometers, loaded cylinders, and the Mohr-Westphal balance are employed for that purpose. Only the pycnometer and hydrometer will be discussed.

a. Pycnometer. Any small flask of 25 or 50 cc capacity with a long, narrow neck and made of thin glass will answer as a specific gravity bottle. Its weight, or tare, is first carefully ascertained and noted; pure water is then poured into the flask until it reaches a convenient distance up into the neck, when a mark should be made with a file at the upper and lower edge of the meniscus or concave surface; having noted the temperature of the water, the flask and contents are weighed, and from this weight the tare of the flask is deducted, the remainder being the weight of that particular volume of pure water at the given temperature. The tare, temperature, and weight of water are carefully etched on the side of the flask, which is now ready to be used for taking the specific gravity of any liquid by filling it to the mark in the neck with the liquid to be tested, then weighing and dividing the net weight of the liquid by the weight of the water, the quotient being the specific gravity of the liquid. *Example:* A flask weighs 324 grams. It holds up to the mark, 647 grams of water. Filled with sulfuric acid, it weighs 1,511.5 grams. $1{,}511.5 - 324 = 1{,}187.5$ grams as the weight of the acid.

Now apply the rule—to divide the weight of a given volume of a liquid by the weight of the same volume of water, the specific gravity is—

$1{,}187.5 \div 647 = 1.835$, the specific gravity of the acid

b. Hydrometers. These instruments are intended to indicate either the density or the specific gravity of liquids, and in some cases also the percentage by volume or weight of certain solutes. They consist of a glass tube having a bulb blown at one end, a little above which the tube is usually expanded cylindrically for a short distance, and then terminates in a long stem in which is securely fastened a graduated scale. The bulb is filled with mercury or small shot, so as to enable the instrument to assume a vertical position when floated in any liquid. Hydrometers, like all floating bodies, displace their own weight of a liquid and sink in it to a depth proportionate to the volume of liquid displaced, which volume is equal in weight to the weight of the instrument; thus, by comparison of volumes displaced, the densities and specific gravities of various liquids can be ascertained. Specific gravity hydrometers are made with the unit mark 1.000 at a point to which the instrument sinks in distilled water at normal temperature, and then have the scale carried above and below this point. The number on the scale at the surface of the liquid represents the specific gravity.

18. SPECIFIC GRAVITY OF SOLIDS. For ascertaining the specific gravity of solids the following general rule is applied:

$$\text{Specific gravity} = \frac{\text{weight of the solid in air}}{\text{weight of an equal volume of water}}$$

Because of certain physical characteristics, solids are grouped under the following heads when their specific gravity is taken:

a. Solids insoluble in and heavier than water. A piece of iron weighs 6.6 Gm in air. Suspended in water it weighs 5.2 Gm. The difference between the weight of the iron in air and that in water is the weight of the water displaced by the iron. Therefore, $6.6 \text{ Gm} - 5.2 \text{ Gm} = 1.4 \text{ Gm}$, which is the weight of the water displaced. Then the—

$$\frac{\text{weight of the substance in air}}{\text{weight of an equal volume of water}} = \frac{6.6}{1.4} = 4.714, \text{ sp. gr. of the iron.}$$

b. Solids insoluble in but lighter than water. When a solid floats on

water it displaces a weight of water equal to its own weight. One that *floats* on water displaces its own weight of that liquid but not its entire volume, since a part of the solid remains above the surface of the water. In order to obtain the weight of water that the entire volume of solid displaces, a sinker, that is, a heavier solid, may be attached to the light substance. This enables one to ascertain the weight of water equal to the volume of the exposed (not immersed) part of the solid. The procedure for determining the specific gravity of a light solid is as follows:

	Gm.
Weight of the solid, e. g., a piece of wax, in air	=9. 01
Weight of the sinker, a piece of lead, in water	=8. 82
Weight of both in water	=7. 88
To the weight of the sinker in water	=8. 82
add the weight of the wax in air	=9. 01
	17. 83
Subtract the weight of both in water	=7. 88
The weight of the water displaced by the wax	9. 95

$$\text{Sp. gr. of the wax} = \frac{\text{weight of the wax in air}}{\text{weight of an equal volume of water}} = \frac{9.01}{9.95}\ \text{Gm} = 0.90$$

c. Solids soluble in water. The procedure in this case is the same as that previously given except that a liquid must be employed in which the solid is insoluble. This necessitates an adjustment because of the difference in the specific gravity of water and the other liquid. This is made by multiplying the specific gravity in reference to the liquid used by the specific gravity of the latter. The following example will illustrate:

	Gm.
A piece of copper sulfate in air weighs	20. 311
The same in oil of turpentine weighs	12. 359
Loss of weight in oil of turpentine	7. 952

This is also the weight of the oil of turpentine displaced by the copper sulfate. The specific gravity as compared with oil of turpentine is $\frac{20.311}{7.952} = 2.566$. This figure must be multiplied by the specific gravity of oil of turpentine, which is 0.865. Then, $2.566 \times 0.865 = 2.119$, the actual specific gravity of copper sulfate (compared with water).

d. Powders insoluble in water. A pycnometer is used for this purpose. The procedure is as follows: Fill the bottle with distilled water and weigh. Weigh accurately a quantity of the powder, whose specific gravity is sought, and introduce this, without loss, into the pycnometer; then fill completely with distilled water. See that there are no air bubbles in the bottle, and weigh. For example—

	Gm.
The bottle filled with water weighs	24
Granulated zinc in air weighs	13. 8
Bottle and zinc, filled with water weigh	35. 8
Add 1 and 2 above (24+13.8)	37. 8
Subtract 3, above	35. 8
Weight of water displaced by zinc	2. 0

Then:

$$\text{sp. gr.} = \frac{\text{weight of the zinc in air}}{\text{weight of an equal volume of water}} = \frac{13.8}{2.0} = 6.9, \text{ sp. gr. of zinc.}$$

e. Powders soluble in water. For this purpose the same method is employed as in d above, except that a liquid is selected in which the substance is not soluble. Here an adjustment must be made by multiplying the specific gravity obtained in comparison with the special liquid used by the specific gravity of that liquid.

19. PRACTICAL APPLICATIONS OF SPECIFIC GRAVITY (REDUCING VOLUME TO WEIGHT). a. Metric.

1 cc of water weighs 1 Gm.
1 cc of any liquid with a sp. gr. of 1 weighs 1 Gm.
1 cc of a liquid with a sp. gr. of 2 weighs 1×2 or 2 Gm.
1 cc of a liquid with a sp. gr. of 1.5 weighs 1×1.5 or 1.5 Gm.

Thus: The number of cc×sp. gr. = weight in grams.

What is the weight in grams of 1 liter of chloroform having a sp. gr. of 1.48?

No. of cc×sp. gr. = weight in grams.
1,000×1.48 = 1,480 Gm, the weight of 1 liter of chloroform.

What is the volume of 750 Gm of chloroform, sp. gr. 1.47?

Since each cubic centimeter weighs 1.47 Gm, $\frac{750}{1.47} = 510.2$ cc.

b. Apothecaries' fluid measure. There is no commensurability of the units between this system and avoirdupois.

1 fl oz of water does NOT weigh 1 ounce.
1 minim of water does NOT weigh 1 grain.

But it is known that—

1 fl oz of water at 4° C. weighs 454.6 grains, and that, therefore—

1 minim of water weighs $\frac{454.6}{480}$ or 0.95 grain.

1 fl oz of water weighs 454.6 gr.
1 fl oz of any liquid having a sp. gr. of 1 weighs 454.6 gr.
1 fl oz of a liquid having a sp. gr. of 2 weighs 454.6×2 or 909.2 gr.

Therefore the weight in grains of a fluidounce of any liquid is 454.6×sp. gr.

Further, any volume in fluidounces may be changed to grains (and thence to higher units) according to the formula: 454.6×sp. gr.×number of fluidounces = weight in grains.

Calculate the weight in grains of 1 pt, 1 fl oz, and 4 dr of sulfuric acid, sp. gr. 1.8.

454.6×sp. gr.×number of fl oz = weight in grains.
1 pt, 1 fl oz, 4 fl dr = 17.5 fl oz.
454.6×1.8×17.5 = 14,319.9 grains.

What is the volume in minims of 480 grs. of chloroform, sp. gr. 1.47?

1 ♏ of H_2O weighs 0.95 gr.

Therefore 0.95×1.45 = 1.3965 grs. per ♏ of $CHCl_3$

$\frac{480}{1.39} = 345.3$ ♏ of $CHCl_3$

(The answer may be resolved into higher units if desired.)

Section III. SPECIFIC VOLUME

20. DEFINITION. a. Specific volume is the ratio of the volume of one body compared with the volume of an equal weight of another body selected as the standard, both bodies having the same temperature, water being the standard unless otherwise stated. Specific volume ratio:

$$\text{Specific volume} = \frac{\text{volume of body}}{\text{volume of an equal weight of water}}$$

b. When the specific gravity of a body is known it is unnecessary to apply the above formula, for specific volume is the reciprocal of specific gravity. Therefore: specific volume = 1 ÷ specific gravity.

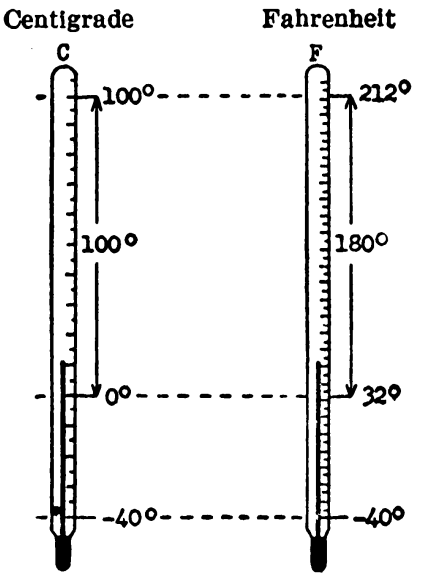
c. Specific volume is used to calculate the space which a certain weight of a substance will occupy. However, if the calculations are made in the metric system, the same results are obtained by dividing the weight by the specific gravity.

Section IV. DENSITY

21. DEFINITION. Density is the relation between the weight of a substance and the volume it occupies. It is a ratio; namely, the ratio between weight and volume—W:V or W/V. Therefore, it may be stated that glycerin has a density of 1.25 Gm/cc, or a specific gravity of 1.25. However, the system of weights and measures used to determine density will alter the figures obtained for the same substance. For example, the following figures have been found to be correct for the measurements of the density for water: 62.4 lb/cu ft, 1 Gm/cc, 454.6 gr/fl oz, yet, the sp. gr. of water is 1.

Section V. THERMOMETERS

22. GENERAL. a. Thermometers are used for measuring temperatures or intensities of heat but the term is generally limited to those instruments that measure temperature by the expansion of some medium such as mercury or alcohol. While these instruments are alike in principle and construction, they are marked in three different scales, but only two of these are in use in this country. The Pharmacopoeia and National Formu-



lary recognize only the centigrade or Celsius scale, although the former book has a table of centigrade and Fahrenheit equivalents. The centigrade scale is used almost exclusively in scientific work the world over while the Fahrenheit scale is the one generally used for manufacturing and household purposes and for taking the temperature of the atmosphere in England, Canada, and the United States.

b. As may be noted on the following diagram, freezing point of water is 0° on the centigrade and 32° on the Fahrenheit scale. Boiling point is 100° on the centigrade and 212° on the Fahrenheit scale. However, −40° is the same on both scales.

23. COMPARISON OF THERMOSTATIC SCALES. See section III, appendix II, Thermometric equivalents.

Section VI. RATIO AND PROPORTION

24. RATIO. a. Ratio is an expression of the relation of one term to another, that is, the amount by which one term is greater or smaller than another, and may be expressed thus 12/4 or 12:4, and is read, 12 is to 4.

b. The ratio of two numbers is the quotient obtained by dividing one term by another. The ratio of 12:4 is 3.

c. The terms of a ratio may be considered as dividend and divisor, both terms of which may be multiplied or divided by the same number without changing their value. Thus, dividing both terms of the ratio 12:4 by 4, the result is 3:1 and in each case their ratio is 3:1.

d. The terms of a ratio taken together form a couplet.

e. Ratio can exist only between numbers of the same unit value: as, the ratio of percent to percent or weight to weight, but, not weight to percent.

25. PROPORTION. a. Proportion is the expression of equality between ratios. It is written thus 12:6::24:12, and is read 12 is to 6 as 24 is to 12.

b. The quotients of each couplet are equal: $12 \div 6 = 2$, $24 \div 12 = 2$.

c. The first and fourth terms are called the extremes. The second and third terms are called the means.

(1) The product of the extremes is equal to the product of the means, $24 \times 6 = 144$, $12 \times 12 = 144$. Therefore, it is apparent that if three terms of a proportion are given the fourth may be found.

(2) Either extreme may be found by dividing the product of the means by the other extreme.

(3) Either mean may be found by dividing the product of the extremes by the other mean.

26. APPLICATION OF PROPORTION. How many grams of 10 percent sulfuric acid can be made from 40 grams of 94 percent acid? Two terms of percent and one term of weight are given and the other term of weight must be determined. Write the proportion and multiply the means, 94×40 and divide by the given extreme, 10, of the proportion to find the unknown extreme. Thus: 10:94::40:X, $10X = 3{,}760$, $X = 376$ which is the number of grams of 10 percent sulfuric acid that can be made from 40 grams of 94 percent acid.

a. Had the problem required the amount of 94 percent acid that could be made from 376 grams of 10 percent acid the following formula would be used: 10:94::X:376, 94X=3,760, X=40 grams of 94 percent acid from 376 grams of 10 percent acid.

b. Had it been required to find the strength of 40 grams of acid which, when diluted to 376 grams, would make a 10 percent acid, the following formula is used: 10:X::40:376, 40X=3,760, X=94 percent, the strength of acid, 40 grams of which when diluted to 376 grams makes a 10 percent acid.

c. If the problem had been to find the strength of acid that could be made by diluting 40 grams of 94 percent acid to 376 grams, the following formula would be used: X:94::40:376, 376X=3,760, X=10 percent, the strength of acid that could be made by diluting 40 grams 94 percent acid to 376 grams.

Section VII. PREPARATION OF SOLUTIONS

27. GENERAL. a. A large proportion of the calculations made during compounding and dispensing is devoted to determining the strength of solutions of various nature. In very dilute solutions, slight errors in calculation may be negligible, yet as the strength of the solution increases, these errors become greater.

b. The strength of a solution or mixture is the proportion of active substance of drug to the solvent, vehicle, or base, and is usually expressed in one of two ways—by the percentage method or by the ratio method. The percentage method will be considered first.

28. PERCENTAGE SOLUTIONS. a. "Percent" is an abbreviation of the Latin, "per centum"; "per" meaning "by" and "centum" meaning "hundred." Ten percent, therefore, means 10 parts in a hundred parts of the total (parts per hundred). A 10 percent solution would therefore contain 10 parts of solute (active ingredient) in every total 100 parts of solution, or every 90 parts of solvent (water unless otherwise indicated). Example:

Weight of solution	100 percent	or 100 parts
Weight of solute	10 percent	or 10 parts
Weight of solvent	90 percent	or 90 parts

b. (1) In connection with solutions, percent or percentage has different meanings under different circumstances as follows: Percent or percentage, "weight in weight" (W/W) expresses the number of grams of an active ingredient in 100 grams of the solution. Percent or percentage, "weight in volume" (W/V) expresses the number of grams of an active ingredient in 100 cubic centimeters of the solution. Percent or percentage, "volume in volume" (V/V) expresses the number of cubic centimeters of an active ingredient in 100 cubic centimeters of the solution.

(2) When the expression "percent" is used in prescriptions without qualification, it is to be interpreted to mean: for solutions of solids in liquids, percent, weight in volume; for solutions of liquids in liquids, percent, volume in volume; and for solutions of gases in liquids, percent, weight in volume. Unless otherwise stated, percentage figures in the Pharmacopoeia are understood to mean weight by weight (W/W).

c. In the calculation of percentage problems it is essential at first for the student to set up a table for each problem as shown in *a* above. Then

the actual amounts of the solute and solvent and total solution may be worked out by proportion and placed alongside corresponding figures in the table. This procedure will enable the technician to check his problem, and eventually this method will be a mental calculation with only the amounts of the actual ingredients to be placed on paper.

(1) *Weight to volume (W/V). (a) When the amount of percentage solution wanted is given. Example:* How many grams of silver nitrate are required to make 150 cc of a 10 percent solution?

Volume of solution	100 percent	150 cc
Volume of solvent	90 percent	x cc
Weight of solute	10 percent	x Gm

A proportion having been set up, it is possible to solve for the number of grams of silver nitrate in 150 cc of solution. Substituting grams or cubic centimeters for the percent sign the following proportion is arranged:

100:10::150:x
100x=150
x=15 grams of silver nitrate required.

(b) When the amount of solute to be used is given. Example: How much 5 percent solution of boric acid may be prepared from 2½ (apothecary) ounces of boric acid? (2½×31.1 grams per ounce=77.75 grams.)

Volume of solution	100 percent	x cc
Volume of solvent	95 percent	x cc
Weight of solute	5 percent	77.75 grams

5:77.75::100:x
5x=7,775
x=1,555 cc of a 5 percent solution of boric acid may be prepared.

(2) *Volume to volume (V/V).* The same table will be used in calculating V/V solutions except "weight of solute" will be changed to "volume of solute."

(a) When the amount of percentage solution wanted is given. Example: How much alcohol is used to prepare 150 cc of 70 percent alcohol?

Volume of solution	100 percent	150 cc
Volume of solvent	30 percent	x cc
Volume of solute	70 percent	x cc

100:150::70:x
100x=10,500
x=105 cc alcohol is required to prepare the solution.

(b) For further calculations. With percentage solutions of V/V proceed as already demonstrated.

Note. When diluting acids, refer to U.S.P. and calculate by W/V.

(3) *Weight to weight (W/W).* When calculating solutions which are specified to be prepared by weight or W/W, proceed as outlined in paragraph c (1) above, substituting the word "weight" for the word "volume."

29. SOLUTION BY RATIO. a. This type of solution is similar to the one just discussed. It is the solution usually designated as 1 in 10, 1 in 500, or 1 in 1,000. Such a statement as 1 in 10 does not mean a total of 11 parts but means in the ratio of 1:10. A 1 in 10 solution is a solution containing 1 part of solute and 9 parts of solvent and would, therefore, be one containing 10 parts in all. This would also be a 10 percent solution. These solutions have their strengths indicated by means of ratios and may be termed "solution by parts."

b. The following are rules for preparing ratio solutions:

Weight to weight (*W/W*). Divide the number of grams of solution desired by the larger number of the ratio and the quotient will be the number of grams of the drug to be used; subtract the number of grams of the drug from the number of grams of finished solution and the remainder will be the number of grams of solvent to use.

Weight to volume (*W/V*). Divide the number of cubic centimeters of solution desired by the larger number of the ratio; the quotient will be the number of grams of the drug to be used and to this is added enough solvent to make the desired number of cubic centimeters of finished solution.

Volume to volume (*V/V*). Divide the number of cubic centimeters of solution desired by the larger number of the ratio; the quotient will be the number of cubic centimeters of the drug to be used and to this is added enough solvent to make the desired number of cubic centimeters of finished solution.

30. STOCK SOLUTIONS. a. A stock solution is any solution which is too strong for ordinary use, and which therefore must be diluted down to the proper strength before using or dispensing. Stock solutions can be of two kinds:

(1) Those which may be purchased. An example of this is concentrated hydrochloric acid, which must be diluted before it can be used medicinally. Any solution of this type is not *primarily* a stock solution but has other uses. Its strength is therefore stated as weight in weight.

(2) Those which are prepared by the technician himself. In solutions of this type, unless otherwise indicated, the strength is given in form of W/V.

b. A stock solution may, for example, be said to contain 10 Gm of silver nitrate in each 100 cc of solution or each cubic centimeter will contain 0.1 Gm of silver nitrate. Therefore, to make up 60 cc of 1.5 percent solution using the 10 percent stock, solution of silver nitrate the following chart may be set up:

Stock solution	*Prescription solution*
10 percent solution or each cc contains 0.1 Gm of silver nitrate.	60 cc of 1.5 percent solution or 60 cc of solution contains x grams of silver nitrate.

$$100:1.5::60:x$$

$$100x = 90$$

$$x = 0.9 \text{ Gm in 60 cc of solution.}$$

Therefore, if 0.9 Gm of solute is required, and each cubic centimeter of stock solution contains 0.1 Gm of silver nitrate, 9 cc of stock solution diluted to 60 cc would give the required 1.5 percent. Or, the following formula may be used:

$$\frac{1}{\text{strength of solution on hand}} \times \frac{\text{strength of solution required}}{1} \times \frac{\text{quantity required}}{1} = \text{amount of stock solution to be used}$$

$$\frac{1}{\frac{100}{10}} \times \frac{1.5}{\frac{100}{1}} \times \frac{6}{\frac{60}{1}} = 9.0 \text{ cc of stock solution required}$$

31. SOLUTIONS INVOLVING SOLUBILITY. The solubility of solids is stated in the U.S.P. as follows: "One Gm of boric acid is soluble in 18 cc of water . . . at 25° C." Since 18 cc of water weighs 18 grams, then 1 gram of boric acid dissolved in 18 cc of water will produce 19 grams of solution, the W/W strength can be expressed by the ratio 1:19. The percent strength of any solution is based on its total weight, and hence would be proportional to the ratio 1:19. This ratio may be changed to percent by a number of methods, all of which give the same result. In this case, for the purpose of uniformity refer to the percentage solution table hitherto discussed:

Weight of solution	= 19 Gm = 100 percent	= 100.00 percent
Weight of solvent	= 18 Gm = (100 − x) percent	= 94.74 percent
Weight of solute	= 1 Gm = x percent	= 5.26 percent

Then by proportion, 19:1::100:x

$$19x = 100$$

$$x = 5.26$$

If some solvent other than water is used, the number of cubic centimeters of liquid would have to be multiplied by its specific gravity in order to give its weight. The case of boric acid is an interesting one in this respect. Its solubility by volume is exactly the same for alcohol as that of water. The following is a repetition of the calculation of the percentage strength of a saturated solution, except that the solvent is alcohol: "One Gm of boric acid is soluble in ——— 18 cc of alcohol ——— at 25° C." The specific gravity of alcohol is 0.816, so 18 cc of it will weigh $18 \times 0.916 = 14.7$ Gm. The saturated solution is then 1:14.7 W/W.

Weight of solution	15.7 Gm = 100 percent	= 100.00 percent
Weight of solvent	14.7 Gm = (100 − x) percent	= 93.64 percent
Weight of solute	1.0 Gm = x percent	= 6.36 percent

Thus a saturated solution of boric acid in water contains 5.26 percent of boric acid, while a saturated solution in alcohol contains 6.36 percent of boric acid, although both are made by dissolving 1 Gm in 18 cc of solvent.

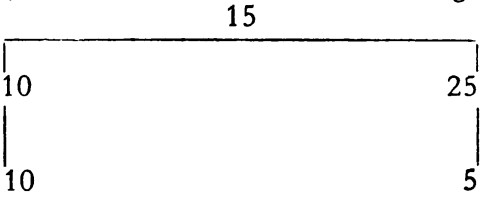
Section VIII. ALLIGATION

32. DEFINITION. a. Alligation or "the rule of mixtures" is an arithmetical rule relating to the solution of problems concerning the compounding or mixing of different ingredients, or ingredients of different qualities or values, and is so named from the method of connecting together the terms in a problem by lines.

b. It is made use of in pharmacy to determine the amounts of two or more strengths of a given substance needed to blend into a new, intermediate strength of that substance. It is also applied in making adjustments of percentage or ratio strengths, and of specific gravity.

33. ALLIGATION PROBLEMS. a. In what proportion must a 25 percent ointment and a 10 percent ointment be mixed to produce a 15 percent ointment? Rule: *Always link together a quantity which is less with one which is greater than the desired percentage, otherwise the answer will be wrong.*

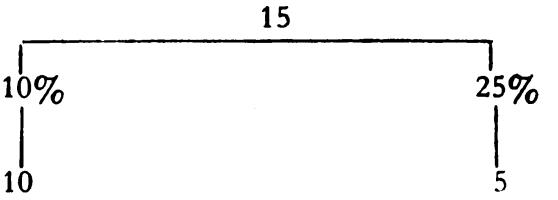
Procedure: Subtract 10 from 15 and place the result under the 25; then subtract 15 from 25 and place the result under the 10.



The ratio obtained is 5:10 or when reduced will read: 1 part of the 25 percent ointment to 2 parts of the 10 percent ointment.

b. To find the amount necessary to make a given quantity. **Example:** How many grams of a 25 percent and a 10 percent ointment are required to make 50 grams of a 15 percent ointment?

For the first step, proceed as above.



2 parts plus 1 part = 3 parts or grams or cubic centimeters, when dealing with metric units.

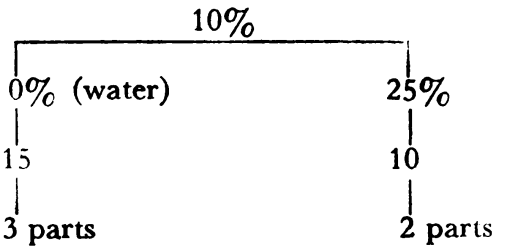
50 Gm ÷ 3 Gm = 16.66 Gm per unit parts.
16.66 Gm × 1 = 16.66 Gm of 25 percent ointment.
16.66 Gm × 2 = 33.32 Gm of 10 percent ointment.
To make 49.98 Gm of 15 percent ointment.

By proportion—

3:50::1:x x = 16.66 Gm of 25 percent ointment.
3:50::2:x x = 33.32 Gm of 10 percent ointment.
To make 49.98 Gm of 15 percent ointment.

c. To find the amount of one ingredient when the amount of the other is given—*Example:* How many cubic centimeters of water must be used to make a 10 percent solution from 50 cc of a 25 percent solution?

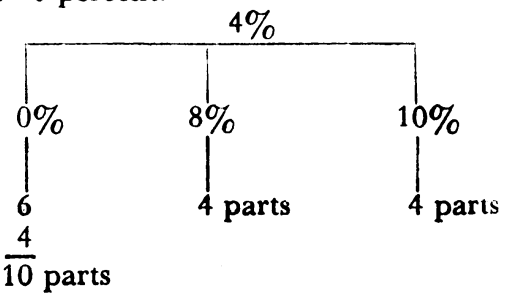
Water, starch, petrolatum, or any other diluting agents are always designated as "0" in alligation problems.



50 ÷ 2 = 25 cc, then, 25 × 3 = 75 cc of water.

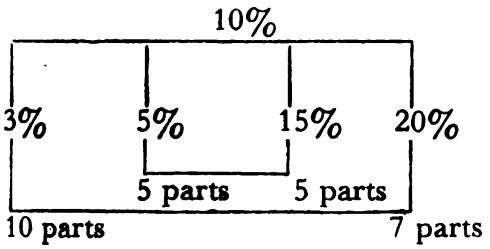
d. When more than two substances of different strengths are to be mixed—*Example:* In what proportion must 8 percent and 10 percent powders be mixed to produce a 4 percent powder? Eight percent and 10 percent are both greater than 4 percent, therefore, starch or some other appropriate diluent should be used as "0 percent."

The 4 is subtracted from both the 8 percent and 10 percent and placed under 0.



Or, 5 parts of diluent, 2 parts of 8 percent, and 2 parts of 10 percent.

Example: In what proportions should a 3, 5, 15, and 20 percent ointment be mixed to produce a 10 percent ointment?



10 parts of 3 percent ointment.
5 parts of 5 percent ointment.
5 parts of 15 percent ointment.
7 parts of 20 percent ointment.

Section IX. REDUCING AND ENLARGING FORMULAS

34. GENERAL. When referring to pharmaceutical reference formulas, and even in prescription compounding, it is often necessary to reduce or expand the formula. An error in this particular operation could cause serious damage to the patient. In order to prevent errors in calculations and to facilitate the conversion of formulas, complete tables are included in the U.S.P. giving the equivalent of practically every value of length, volume, and weight employed in pharmacy.

Tables are also given for converting metric quantities in pharmaceutical processes to quantities in the avoirdupois system, in the fluid system, and in the apothecaries' system. *For example:* grains per liter, grains, ounces, and pounds per fluidounce, per pint and per gallon are given; for cc per liter, minims, fluidounces and pints per fluidounce, per pint and per gallon; and for grams per kilogram, grains and apothecaries' ounces per pound avoirdupois; also grains and ounces avoirdupois. Using these tables, official formulas which are given in the metric system can be converted into pounds avoirdupois or into fluidounces, pints, or gallons. (See pages 79, 80, and 81.)

35. REDUCING OR ENLARGING A FORMULA. a. To reduce a formula, the amount of each ingredient is divided by the total amount specified in the formula and multiplied by the amount desired. Example: Prepare 120 cc of solution of potassium arsenite.

U.S.P. formula—

Arsenic trioxide	10 Gm
Potassium bicarbonate	7.6 Gm
Alcohol	30 cc
Distilled water, a sufficient quantity to make	1,000 cc

$\frac{120}{1{,}000} \times \frac{10}{X} = 1.2$ Gm of arsenic trioxide for 120 cc formula.

$\frac{120}{1{,}000} \times \frac{7.6}{X} = 0.91$ Gm of potassium bicarbonate for 120 cc formula.

$\frac{120}{1{,}000} \times \frac{30}{1} = 3.6$ cc of alcohol for 120 cc formula.

Distilled water, a sufficient quantity to make 120 cc.

b. To enlarge this same formula to 1,500 cc of solution of potassium arsenite the same procedure is followed.

$\frac{1{,}500}{1{,}000} \times \frac{10}{X} = 15$ Gm of arsenic trioxide for 120 cc formula

Continue as above for other ingredients in the formula.

Section X. CALCULATION OF DOSES

36. VARIATION ACCORDING TO AGE. The young and the old require smaller doses than those in the prime of adult life. The following

table gives the range of doses, according to age, as used at Guy's Hospital, London.

Age	*Dose*	*Age*	*Dose*
1 month	1/20	7 and 8 years	1/2
3 months	1/15	10 to 12 years	2/3
6 months	1/10	13 to 15 years	3/4
9 months	1/9	18 to 20 years	5/6
1 year	1/7	21 to 45 years	1
2 years	1/6	50 years	5/6
3 years	1/5	60 to 70 years	3/4
4 years	1/4	80 to 90 years	2/3
5 and 6 years	1/3		

A rule for estimating doses for children over one year, and known as Young's Rule, is to divide the age in years by the age plus 12. Thus for a child of 3 years the dose will be $3 \div (3+12)$ or 1/5 of the adult dose.

It is well to bear in mind that children, especially very young children, do not tolerate opiates well; consequently smaller doses of opiates than figured by the above rule or table should be given. On the other hand, children can well take proportionately larger doses of calomel and other cathartics and of atropine and arsenic.

37. MEDICINAL INGREDIENTS IN PRESCRIPTIONS. **a.** The technician should understand the method by which the physician builds up the prescription from the standpoint of the dose of each ingredient, indicating the number of doses to be prepared. The amount of each medicinal material to be taken at a single dose can be observed at a glance, and the total quantity of each ingredient to be used in filling the prescriptions can be found by simple multiplication. Prescriptions for powders and capsules are frequently written in this manner. Liquid prescriptions, on the other hand, are practically always written to indicate the total amount of each ingredient in a given volume. In order to calculate the dose of each ingredient, the technician must first determine the total number of doses in the prescription and then divide the indicated quantity of each ingredient by this figure.

b. *Example:* What is the dose of each ingredient in the following prescription?

℞

Sodium bromide	30
Potassium bromide	50
Distilled water, to make	120

Directions: Teaspoonful at bed time.

Each teaspoonful represents approximately 4 cc. Therefore, $120 \div 4 = 30$ doses. 30 grams of sodium bromide divided by 30 doses equals 1 gram of sodium bromide per dose. 50 grams of potassium bromide divided by 30 doses equals 1.66 grams of potassium bromide per dose.

CHAPTER 3

PHYSICAL PROCESSES AND TECHNIQUES

38. METHODS OF HEATING. In order to control and distribute heat, baths of various types are used. Many medicinal products are injured by the application of excessive heat. A bath permits the even distribution of heat to the contents of the container placed within it and avoids the possibility of the cracking of such a container (if of glass) through a sudden change in temperature.

a. Water baths. Water baths usually consist of copper or Monel metal containers equipped with a number of concentric rings of the same material so fashioned that they form a lid or cover for the apparatus. This allows the technician to make adjustment for various sizes of flasks, evaporating dishes, etc. A short, horizontal tube is provided near the top of the bath for the escape of steam. Since both the water in the bath and the steam arising from it are under atmospheric pressure, the highest temperature obtainable is 100° C., thus preventing damage to any substance which is not injured by heating to that point. If heating is to be continued for a long period, it is necessary to add water from time to time to replace that lost by evaporation.

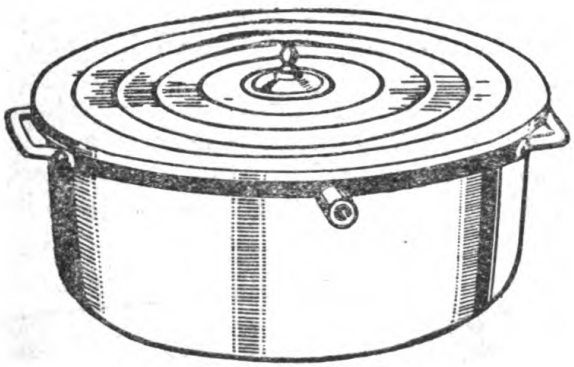


Figure 5. Water bath.

b. Sand baths. Sand baths consist of shallow pans usually made of sheet iron and filled to a depth of about ½ inch with fine, dry, clean sand. The vessel to be heated is embedded slightly in the layer of sand which serves to distribute the heat evenly. Care must be observed in the use of this type of bath, since the temperature may rise to a very high point. Hence, the amount of heat must be regulated by adjusting the gas burner.

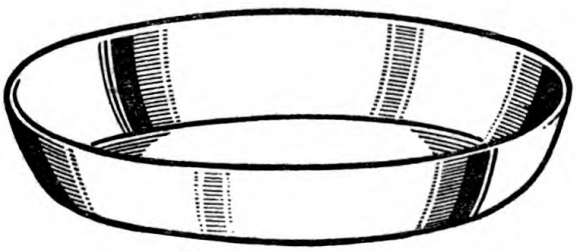


Figure 6. Sand bath.

c. Oil baths. Oil baths are prepared by partially filling a metal or enamel ware container with heavy mineral oil, a fixed vegetable oil, paraffin, or glycerin. Such baths will attain a maximum temperature of about 250° C., although disagreeable fumes are usually evolved at temperatures considerably below this. Care must be observed not to heat the oil to its flash point.

d. Salt water baths. Salt water baths consist of saturated aqueous solutions of various salts. By selecting the proper salt, temperatures varying from 108° C. to 179° C. may be obtained.

e. Air baths. Air baths consist of metal cabinets equipped with one or more shelves and closed by means of a door. Heat is supplied either by gas or electricity; the latter type of equipment is usually thermostatically controlled. Air baths are used principally for drying chemicals for analysis.

f. Steam baths. Steam baths are of two types: without and with pressure. In the first type, steam is piped to a metallic vessel resembling a water bath. The vessel to be heated rests on the top of the bath, its undersurface being heated by the incoming steam. As the latter condenses, it is carried off by a drip pipe. A temperature of about 100° C. may be maintained by this method. If steam is used under pressure, it is superheated to temperatures above 100° C. Steam at atmospheric pressure (14.7 lbs. per sq. in.) has a temperature of 100° C., but under a pressure of 100 lbs. per sq. in., it reaches a temperature of over 164° C.

39. PRACTICAL APPLICATION OF HEAT. a. Evaporation. In pharmacy, evaporation signifies the process of driving off as a vapor the volatile portion of a liquid by the application of heat. Such a liquid may consist of a solution of a nonvolatile substance in water, alcohol, or other solvent; the purpose of this operation is to concentrate the solution or to obtain the solute in a dry form. Evaporation may be hastened by (1) using a shallow evaporating dish which exposes as large a surface of the solution as possible; (2) constant stirring which allows the free escape of the vapors and assures the even heating of the entire quantity of liquid; and (3) the use of sufficient heat.

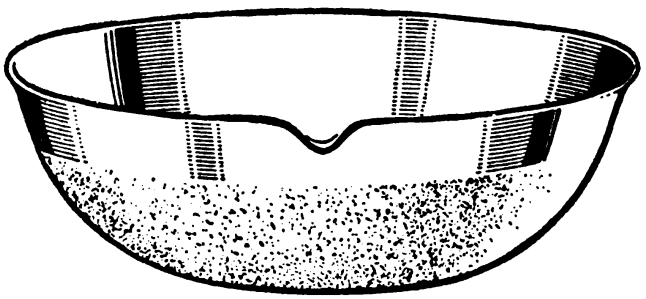


Figure 7. Evaporating dish.

b. Distillation. Distillation is the separation of the constituents of a liquid mixture by vaporization and subsequent condensation of the vapors. Such a separation is made possible by the different boiling points of the various volatile constituents. The equipment necessary for this process consists of a *flask*, a *condenser*, and a *receiver*. The liquid to be subjected to distillation is placed in the flask. When, upon the application of heat, the temperature has reached the boiling point of the lowest-boiling volatile constituent, the vapors of this substance rise to the neck of the flask and pass

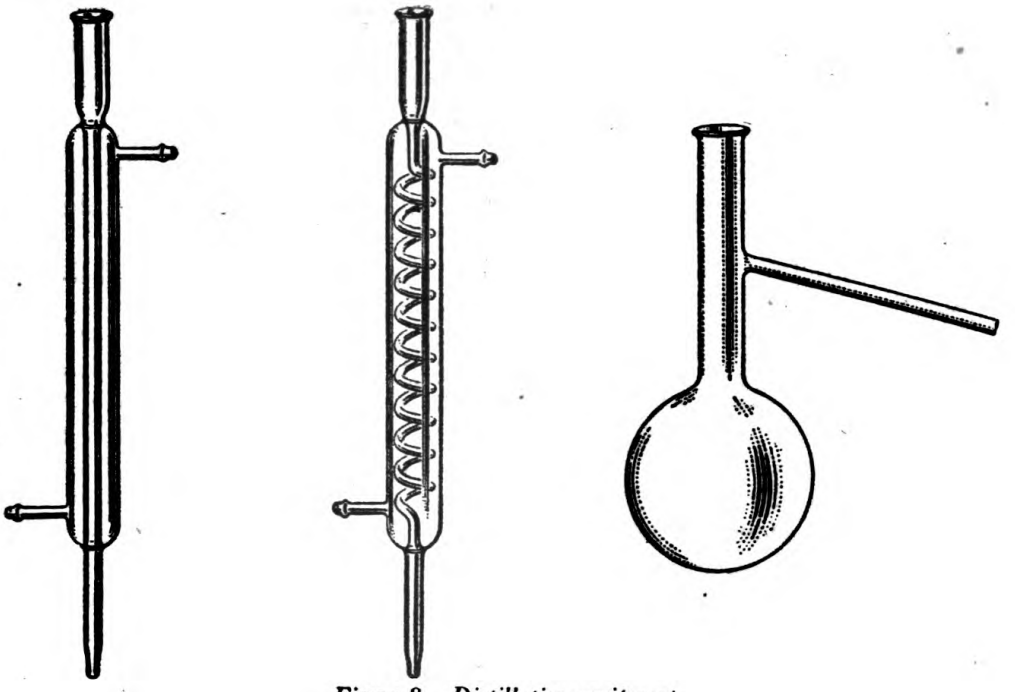


Figure 8. Distillation equipment.

through the side arm, with which it is provided, into the condenser. This device is usually equipped with a water jacket for the purpose of cooling the tube containing the vapors; the latter are, thereby, condensed into liquid form. The distillate (condensate) then drops into the receiver. A troublesome phenomenon called "bumping" often occurs during distillation. It is caused by a sudden release of vapor and may be severe enough to throw some of the liquid into the condenser, thereby contaminating the distillate. It may be controlled by placing a few porcelain chips, bits of broken glass, or glass beads in the flask before application of heat.

(1) *Steam distillation.* This process consists of passing steam into the flask containing the substance to be distilled, which must be immiscible with water, and condensing the vapor. By this means, many volatile organic substances may be distilled without the decomposition which would occur if ordinary distillation were employed. The combined aqueous and organic distillate collects in two layers in the receiver and may be separated easily.

(2) *Fractional distillation.* Frequently in analytical procedure, it is necessary to separate a liquid mixture into its components. This may be accomplished by fractional distillation. In this process, a thermometer is placed within the distilling flask in such a position that its bulb is level with the side arm. Heat is applied to the flask, and when the vapor of the lowest-boiling component begins to pass through the side arm, the temperature is recorded. The resulting distillate is collected as long as the temperature remains approximately constant. As the temperature rises, another receiver is substituted for the first one, and the new temperature recorded; this procedure is continued until practically all of the liquid has been distilled.

If the distilling temperature is so high that at least partial decomposition is likely to occur, the process may be conducted under diminished pressure through the use of an aspirator or vacuum pump. This results in distillation at a temperature considerably below the boiling point at atmospheric pressure.

(3) *Destructive distillation.* This process is applied to dry organic matter

for the purpose of separating all volatile substances, the vapors of which are condensed and collected in the usual way. Owing to the fact that little air is present within the system, incomplete combustion occurs, and a carbonaceous residue remains within the flask. Glass vessels are not well adapted to this technique because of the high temperature involved, and consequently, the distilling flask usually consists of an iron oven of special design.

(4) *Rectification* is the purification of volatile substances by distillation. It is used frequently in pharmacy for the purification of alcohol.

c. Sublimation. This is the process of distilling volatile solids, the product of which is called a *sublimate*. On a small scale this can be performed with simple equipment. The material is ground or mixed with sand and placed in a flask with a short neck, the end of which passes through a hole in a box which serves as a condenser. Upon careful heating, the volatile material vaporizes, and since the temperature of the box is much lower than that of the flask, the vapor condenses. Iodine may be sublimed by heating in a small evaporating dish over which a glass funnel is inverted.

d. Fusion. The process of liquefying solid substances by the application of heat, without the use of a solvent, is fusion. It is applied to solid fats, waxes, etc., to insure an intimate mixture with other substances, for example, in the manufacture of an ointment.

e. Desiccation. Desiccation is a dehydration process for removing moisture from solid substances. The moisture, thus driven off, is called *hygroscopic moisture*, as distinguished from that which is chemically combined, as water of crystallization, in some compounds. It should be conducted at as low a temperature as possible; this may be accomplished by exposing the substance to a dry atmosphere at ordinary temperature or by placing it in a drying oven at a moderate temperature.

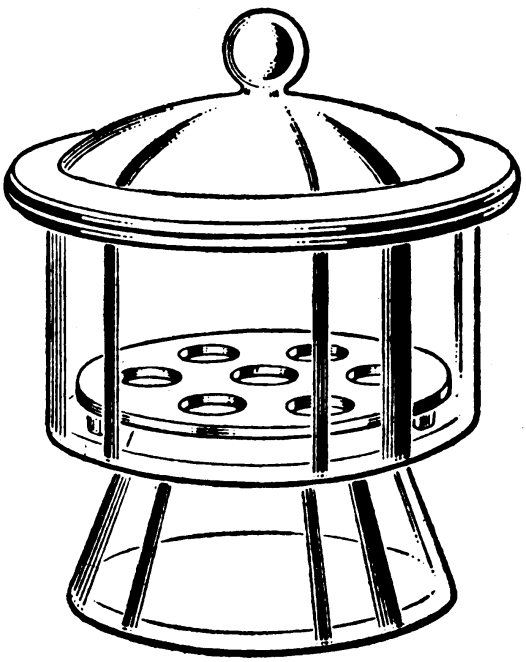


Figure 9. Desiccator.

f. Exsiccation. The removal of water of crystallization, or moisture, from a solid crystalline substance by heating it strongly is exsiccation. It is conducted by first exposing the crystals to the air, or to a warm temperature, until they have effloresced, after which they are heated with stirring,

until they cease to lose weight. Exsiccated substances should be stored in tightly closed containers.

g. Torrefaction. Torrefaction is the process of roasting certain organic substances in order to modify some of their constituents. The amount of heat applied is not sufficient to carbonize the substance. Rhubarb, in the form of coarse, dry powder, loses its cathartic properties, but retains its astringent action when subjected to torrefaction.

h. Carbonization. The heating of organic substances, without access to air, until the volatile products have been driven off is carbonization. The charred residue consists of carbon.

i. Calcination. The process of separating volatile substances from fixed inorganic matter by the application of heat without fusion is calcination.

j. Ignition. Ignition is the process of strongly heating solid, or semi-solid, substances to a definite and limited degree, the residue being the product sought.

k. Incineration. Incineration is the process of strongly heating organic substances, without access to air, until all of the carbon has disappeared, the ash which remains being the object sought.

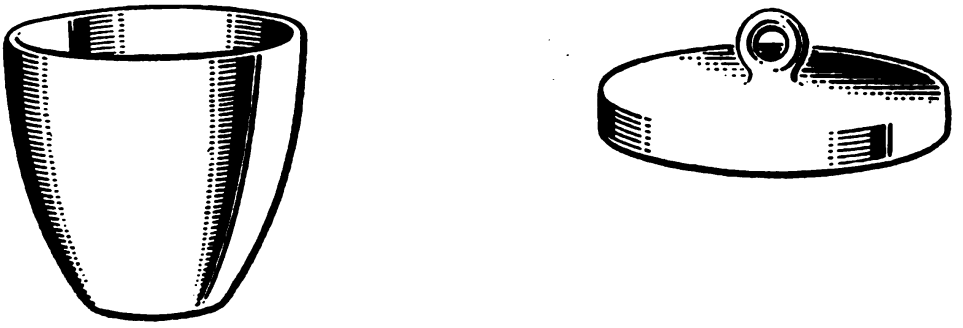


Figure 10. Crucible and cover.

40. FILTRATION. Filtration is the process of separating solid material from a liquid by the intervention of a porous medium called a filter. Filters may be made of paper, asbestos, glass wool, siliceous earth, sand, charcoal porous stone, or other insoluble material. The paper filter is usually used in pharmaceutical work, and for most operations, the form used is the *plain filter*. To fold this type of filter, place a circular sheet of filter paper on the desk, and fold it through the center so as to form a half circle. Again, fold this in the middle. Then, open the paper to a cone-shape; one of the four equal sectors, thus created, will rest against one side of the funnel, and the remaining three sectors will form three thicknesses of paper on the other side.

41. STRAINING OR COLATION. This is the process of separating a solid from a liquid by pouring the mixture upon a cloth or porous material. It differs from filtration in that the medium has larger pores; it can be employed only if the solid material exists in the form of coarse particles.

42. DECANTATION. Decantation is the process of pouring off a supernatant liquid from a quantity of some insoluble solid substance, for example, a precipitate which has been allowed to subside and collect at the bottom of the container.

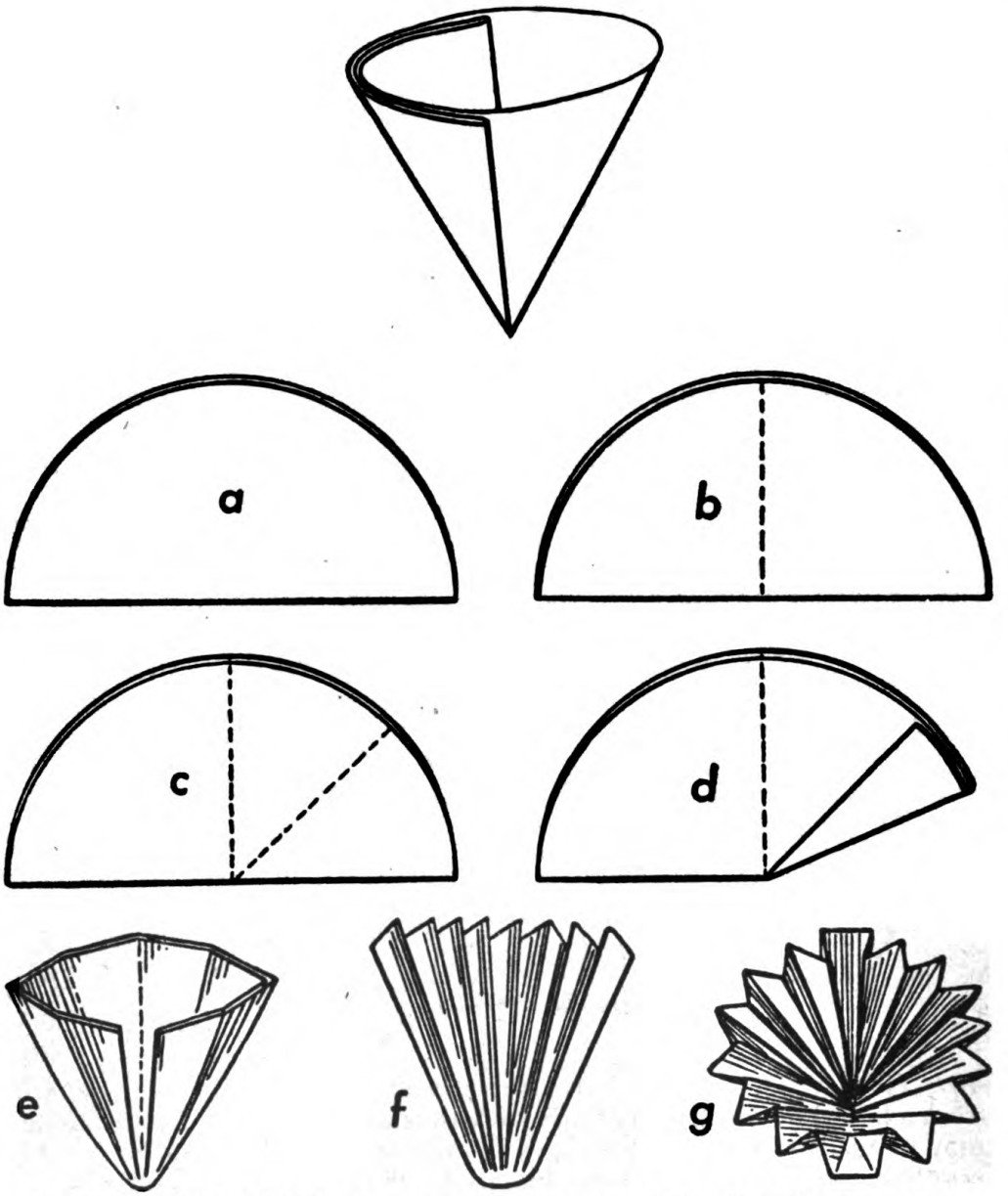


Figure 11. Methods of folding filter paper. a and b steps in folding plain filter shown at top. c-g additional steps for folded plaited filter.

43. PRECIPITATION. Precipitation is the process of separating solid particles from a previously clear liquid by physical or chemical means. It is employed extensively in qualitative and quantitative analysis, as well as in the manufacture of many substances. The *precipitant* is the chemical in solution which brings about this change; the *precipitate* is the insoluble substance which separates. The liquid which remains above the precipitate is called the *supernatant liquid.*

The addition of an aqueous solution of silver nitrate to an aqueous solution of sodium chloride results in the precipitation of silver chloride, while the other product of the chemical reaction, sodium nitrate, remains in solution. Such a reaction is called a double decomposition. Not all precipitations, however, involve chemical reactions. For example, the addition of alcohol to an aqueous solution of a gum such as acacia causes precipitation.

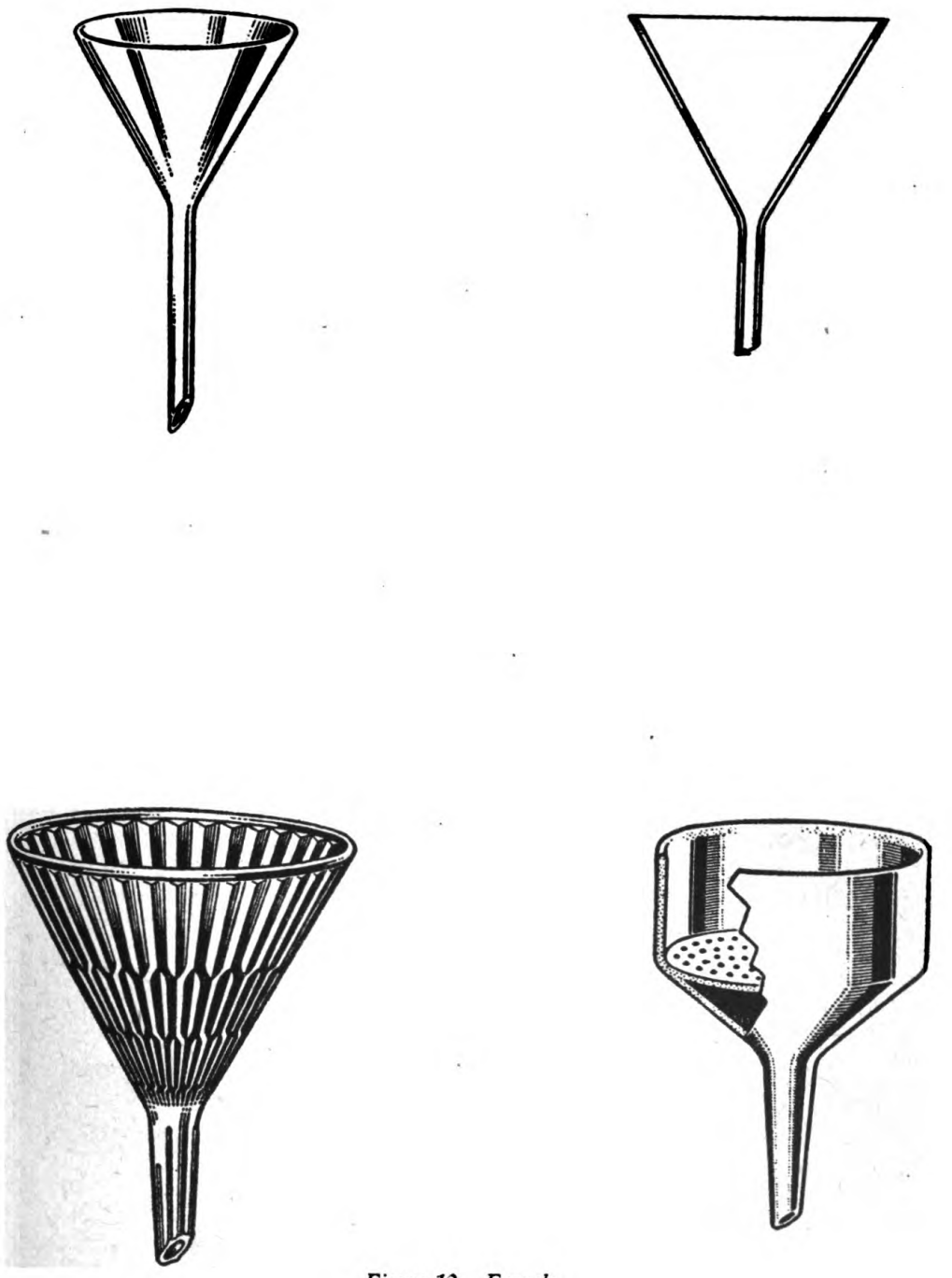


Figure 12. Funnels.

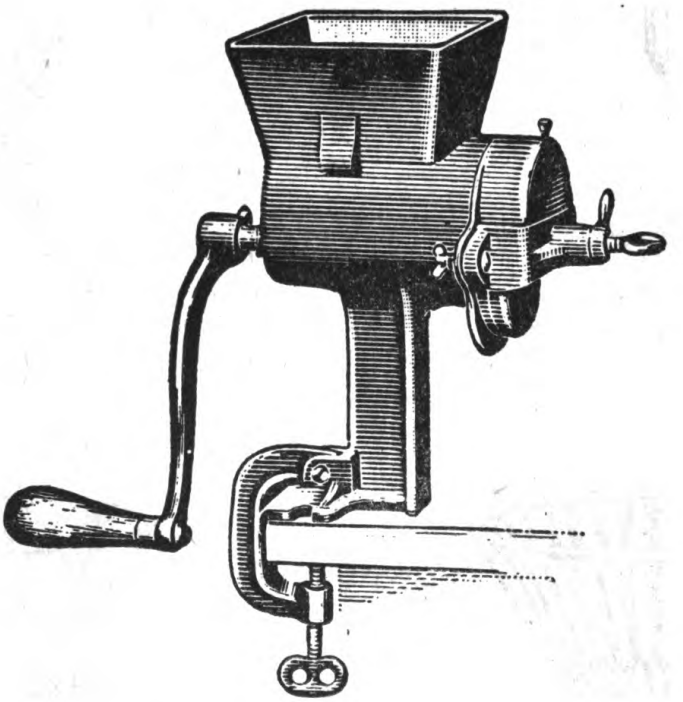
44. COMMINUTION. Comminution is the process of reducing drugs to a finer state of subdivision. The various processes of comminution are as follows:

a. Contusion. Contusion is the process of bruising, or crushing, a drug by placing it in a heavy mortar and pounding it with a heavy pestle.

b. Trituration. The reduction of a substance to a fine powder by rubbing it in a mortar with a pestle is trituration.

c. Grinding and pulverizing. The former term is applied to the reduction of a substance by mechanical means to *coarse* particles; the latter

Figure 13. Mortars and pestles.



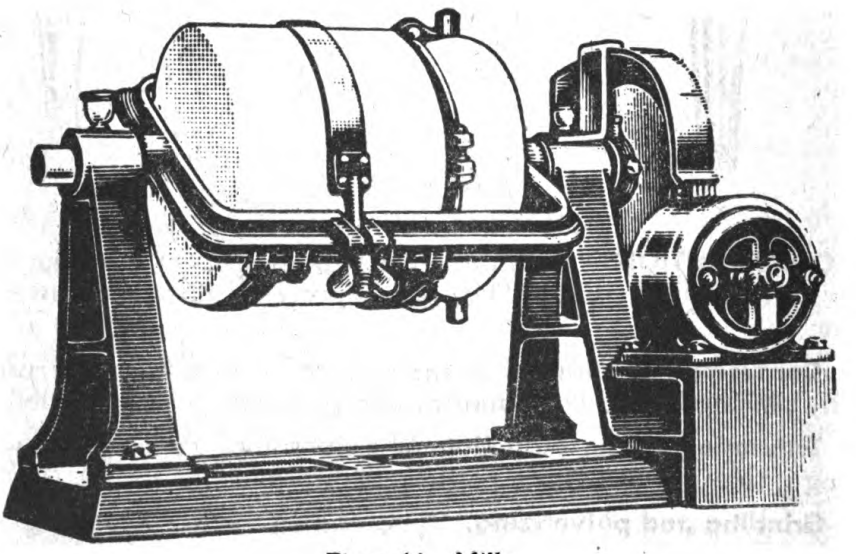


Figure 14. Mills.

is applied to the production of *fine* particles. These processes are carried out in drug mills of various types.

d. Pulverization by intervention. This is the process of reducing substances to powder through the use of a foreign substance, from which the powder is subsequently freed by some simple method. It is used for substances which are difficult to reduce to powder by ordinary trituration. For example, camphor may readily be triturated, if a few drops of alcohol or ether are added. Iodine crystals may be reduced in size by triturating them with a little dry, clean sand; the latter remains behind when a solvent for the iodine is subsequently added.

e. Levigation. Levigation is the process of reducing substances to a state of very fine subdivision by triturating them after they have been made into a paste with water or other liquid in which they are insoluble. This technique may be performed by the use of either a shallow mortar and properly fitting pestle or a ground glass, or porcelain, slab and a spatula. The process is termed *porphyrization* when it is performed with a slab and muller made of porphyry.

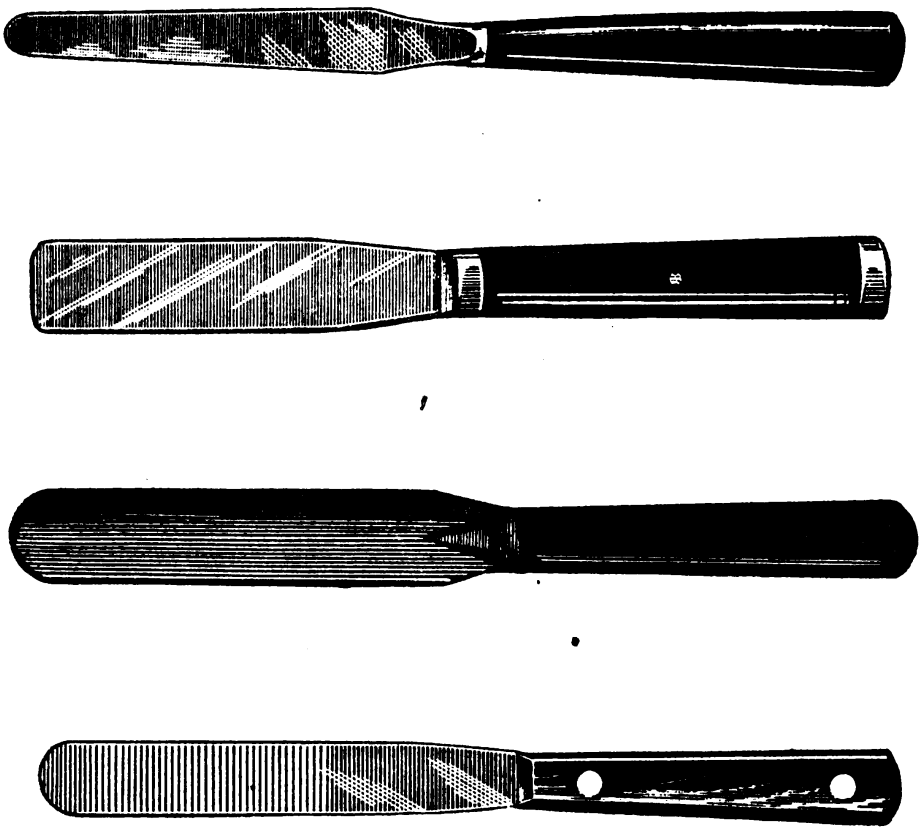


Figure 15. Spatulas.

f. Elutriation. Elutriation, or water-sifting, is the process of obtaining a substance in fine powder by suspending the substance in water, in which it must necessarily be insoluble, and allowing the coarser particles to subside. Following this, the portion of the water in which the finer particles are suspended is decanted, and the latter are collected and dried.

45. SOLUTION. **a.** A solution is a chemically and physically homogeneous mixture of two or more substances. The term was originally limited to homogeneous liquid mixtures, but it now includes solid or gaseous homogeneous mixtures. A solution is composed of the dispersed substance or substances, called the solute, and the dispersing medium, or solvent. A solution is said to be saturated when the solvent has dissolved as much of any solute as it can hold in solution under specified conditions of temperature and pressure. Under certain conditions, a supersaturated solution may result, for example, when a solution is saturated at one temperature, the excess of solid solute removed, and the solution cooled.

b. Two kinds of solutions are generally recognized:

(1) *Simple solution.* This is one in which the solute dissolves without undergoing chemical change; if the solvent is removed by evaporation, the solute may be recovered unchanged.

(2) *Chemical solution.* This is one in which a chemical reaction occurs when solution is effected, the identity of the solute being changed either by the action of the solvent or of other ingredients of the solution. Evaporation of the solvent fails to yield the original substance or substances.

c. Conditions which influence the rate and extent of solubility are—

(1) *Temperature.* The application of heat usually increases the rapidity of solution, as well as the concentration of the solute possible for a given amount of solvent.

(2) *Particle size.* Reducing the substance to a finer state of subdivision greatly increases its surface area and consequently hastens the process of solution.

(3) *Agitation.* Stirring a mixture of solute and solvent removes from the surface of the former the concentrated solution which forms about it, thereby increasing the rate of solution.

(4) *Selection of solvent.* If it becomes permissible to choose among several solvents, select the one in which the solute is most readily soluble.

d. Important solvents and their properties are—

(1) *Water.* The most useful of all solvents. The majority of the inorganic salts, as well as sugar, glycosides, most alkaloidal salts, etc., are water-soluble.

(2) *Alcohol.* Dissolves resins, volatile oils, alkaloids, and many other plant products. Alcohol also possesses valuable preservative properties.

(3) *Glycerin.* A useful solvent, although more limited in application than either water or alcohol. It dissolves the fixed alkalies, a number of neutral salts, pepsin, tannin, gums, etc. In a concentration of 25 percent or more, it exerts a preservative action on solutions.

(4) *Oils.* Fixed oils are used as solvents in liniments and similar preparations.

(5) *Acid and alkaline solutions.* Of limited application. Dilute solutions of acids may be employed as solvents for alkaloids, converting them to readily soluble salts.

(6) *Miscible solvents.* Liquids that mix with each other in all proportions.

(7) *Immiscible solvents.* Immiscible solvents are those that will not mix with each other.

(8) *Solutions of gases in liquids.* The solubility of gases in liquids decreases proportionally with increase in temperature. The solubility of gases in liquids increases proportionally with increase in pressure.

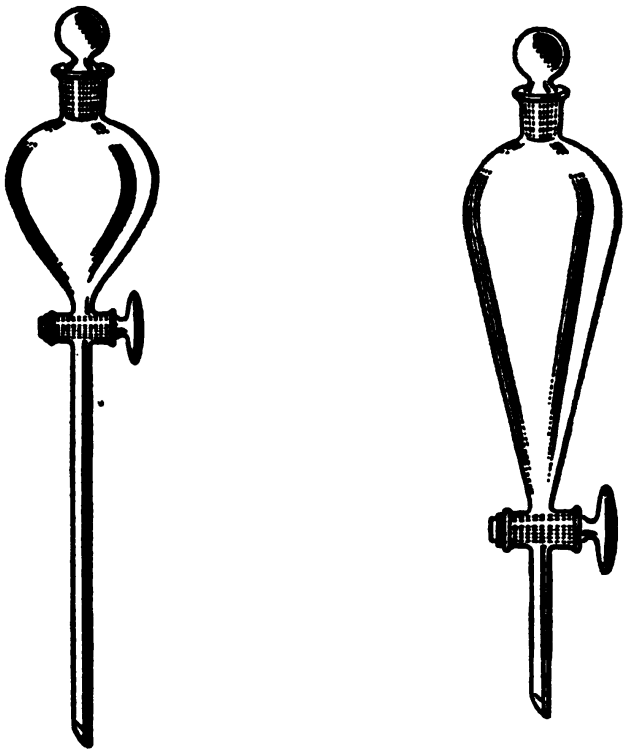


Figure 16. Devices for separating immiscible solvents.

46. EXTRACTION. This is the process of separating mixtures of soluble and insoluble substances contained in drugs through the use of a solvent which is called the *menstruum*. The purpose of such treatment may be to obtain the soluble portion, or to purify the insoluble portion. The processes of extraction used in pharmacy are as follows:

a. Maceration is the process of soaking the properly comminuted drug in the menstruum at room temperature until the cellular structure is thoroughly penetrated, and the soluble portions softened and dissolved. Digestion is a modification of maceration in which gentle heat is applied to the mixture of menstruum and drug. Unless otherwise specified, the temperature should be from 30° to 40° C. If the menstruum is readily volatile at that temperature, it is necessary to use a reflux condenser in order to recover and return the escaping solvent.

b. Infusion is the process of treating vegetable drugs with either hot or cold water, allowing the mixture to stand for a specified time, and separating the aqueous portion from the drug. The drug is not subjected to the process of boiling, though it is common practice to pour boiling water over it and then to cover the vessel.

c. Decoction is the process of pouring cold water over the drug, covering the vessel, and after bringing the mixture to the boiling point, boiling it for 15 minutes. After the mixture has cooled to 40° C., the aqueous extract is separated from the drug.

d. Percolation is the process in which a powdered drug, contained in a vessel called a percolator, is deprived of its soluble constituents by the descent of a solvent through it. The solution of these active principles in the menstruum is called the *percolate*.

(1) *Apparatus.* (*a*) The percolator consists of a cylindrical vessel of glass or metal provided with an orifice at the lower end.

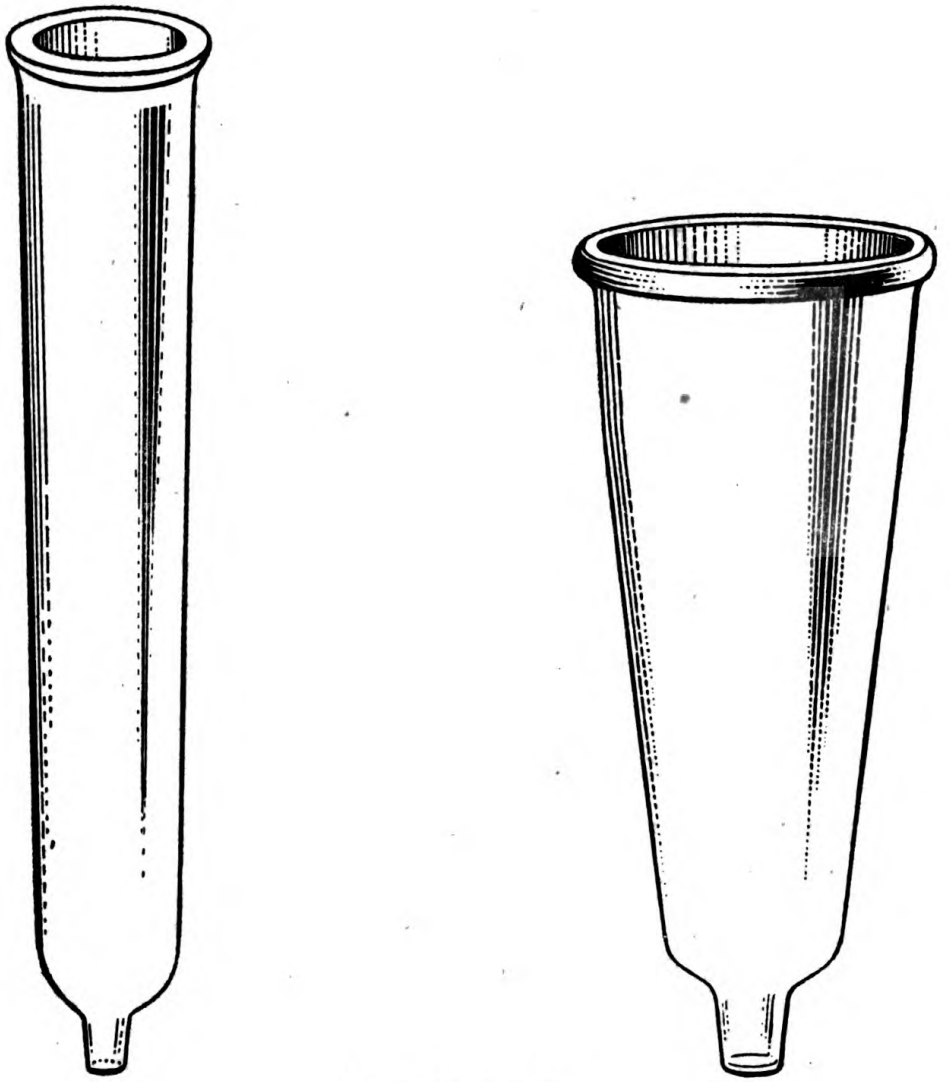


Figure 17. Percolators.

(*b*) The receiver for the percolate may be a graduated wide-mouthed bottle placed at the orifice of the percolator.

(*c*) In order to regulate the flow of the percolate, use the following arrangement: Insert a perforated cork, through which passes a short glass tube, into the orifice of the percolator. The upper end of the glass tube should be flush with the upper surface of the cork, and the lower end should project about 3 to 4 cm beyond the lower surface of the cork. Place a tightly fitting rubber tube, at least one-fourth longer than the percolator, over the protruding end of the glass tube. Into the other end of the rubber tube, insert a bent glass tube. The rubber tube can be held in an upright position by hooking the bent glass tube over the top of the percolator during maceration; the rubber tube may be raised or lowered to regulate the flow of the percolate when percolation has started.

(2) *Steps in operation.* (*a*) *Comminution.* The drug must be reduced to particles of uniform size, the degree of fineness varying with different drugs, the ease with which the menstruum will dissolve its soluble constituents, the length of time required to perform extraction to exhaustion, and the proportion of menstruum to drug.

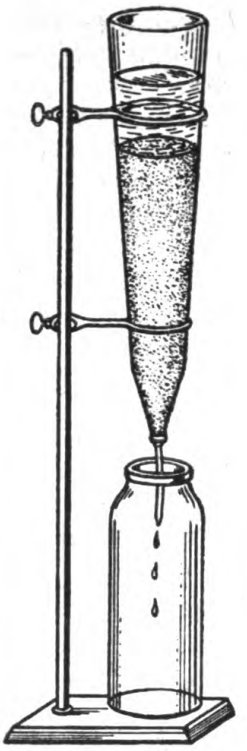


Figure 18. Percolator with receiver.

(*b*) *Maceration.* Before packing the drug in the percolator, it is necessary to moisten it with the prescribed menstruum. Unless this is done, the swelling which takes place when the menstruum penetrates the compressed, dried cells of the drug, will shut off the flow of percolate. The drug powder may be moistened by placing it in a suitable, shallow container, adding the required quantity of menstruum and thoroughly mixing the latter with the drug by stirring. After the drug has been moistened, the vessel should be covered and allowed to stand for about half an hour in order that the cells may swell to their normal size.

(*c*) *Packing of the drug.* Place a thin layer of absorbent cotton within the percolator, over its orifice, in order to prevent the escape of any of the drug. Transfer about one-fifth of the moistened drug to the percolator at one time. When the first portions are being added, the percolator is tapped or rotated until the drug presents an even surface. It is now packed with a large cork, which may be affixed to one end of a stout glass rod or tube, or preferably with a "packer" made of hardwood. The first portion should be packed somewhat lightly and each succeeding layer a little more firmly; the last layer is packed quite firmly. A sheet of filter paper of appropriate size is placed upon the surface of the drug and held in place by means of glass stoppers, glass marbles, or pieces of glass rod or tubing. The menstruum is now added in divided portions, care being taken to follow with the succeeding portion before the first has entirely disappeared beneath the surface of the drug; otherwise, fissures will appear in the drug, and extraction will not be uniform. A glass plate is placed over the top of the percolator. As soon as the menstruum has permeated the entire column of drug, the lower orifice is closed either by raising the rubber tubing, as described previously, or by using a clamp on the tubing. The drug is now allowed to macerate for the prescribed length of time.

(*d*) *Percolation rate of flow.* After the drug has been macerated for the specified length of time, percolation is allowed to proceed at the rate of flow specified by the United States Pharmacopoeia (U.S.P.) in each case: "percolate slowly" means not more than 1 cc. per minute; "percolate at a moderate rate" means at a rate of 1 to 3 cc. per minute; "percolate rapidly" means at a rate of 3 to 5 cc. per minute. These terms are defined upon the basis of 1,000 grams of drug. The rate of flow is regulated as explained in d (1) (*c*) above.

(*e*) *Finishing the process.* The official directions are frequently definite in fixing the quantity of percolate to be received from a given quantity of powder, but the often repeated direction to "percolate to exhaustion" at once raises the question of when a drug is exhausted of its activity. This question can be properly answered only by knowing beforehand the active principles of the drug. For example, if the drug's activity resides in its bitter principles, the absence of bitterness in the percolate in such cases indicates exhaustion; if the drug is used for its coloring matter, the absence of color in the percolate indicates exhaustion, etc.

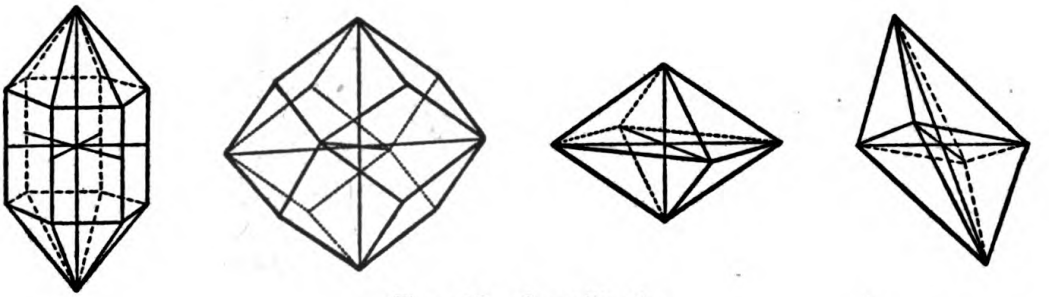


Figure 19. Crystallization.

47. CRYSTALLIZATION. a. Crystallization is the process by which atoms and molecules arrange themselves into definite geometrical patterns called *crystals.* Substances in which the atoms and molecules are distributed in a random manner throughout the solid are said to be *amorphous.* The object of producing substances in crystalline form is to obtain them in a high degree of purity.

b. The several ways in which crystals are produced are as follows:

(1) *By cooling a liquid.* It is possible to crystallize the liquid itself, in this manner. The most common example of this is the freezing of water to form ice. If benzene is chilled to 5.25° C., it crystallizes. Another illustration is offered by melting sulfur in a casserole and partially cooling the fused material until a pellicle forms over the top. If a hole is now punched through the crust, and the remaining molten sulfur poured out, it will be found that crystals of sulfur have formed on the walls of the casserole and on the undersurface of the crust.

(2) *From a solution.* (*a*) *By cooling the solution.* This is the method most commonly employed in the preparation of crystals. If cooling takes place slowly, without agitation, the crystals which separate are larger than those obtained by the rapid cooling and stirring of a hot solution.

(*b*) *By evaporation of the solvent.* This process is especially useful where the solvent is more volatile than water, for example, alcohol, ether, chloroform, or petroleum benzin. In such cases, the chemical is dissolved in the smallest possible quantity of the solvent, the solution filtered into an evaporating or crystallizing dish, and allowed to stand. The spontaneous

evaporation of the solvent causes crystals to be deposited in the bottom of the dish.

(*c*) *By effecting a change in the character of the solvent.* Some substances are soluble in one solvent and insoluble in another. It is, thus, often possible, by the selection of the appropriate solvent, to cause a solute to separate from solution in the form of crystals.

(*d*) *By chemical action.* The interaction of two solutes, which occurs when their solutions are mixed, may be used to form a new substance which may precipitate from solution. The reaction between a gas and a solution (for example, hydrogen sulfide and solutions of metals) and the reaction between a solid and a solution (for example, metallic iron and cupric sulfate solution, which precipitates metallic copper) furnish other examples of this type.

(*e*) *By electrolytic deposition.* This method is commonly known as electroplating, and the deposited metal consists of extremely small crystals.

(*f*) *By loss of dissolved gases.* Some of the calcium salts found in hard water are held in solution, as calcium bicarbonate, $CaH_2(CO_3)_2$. On boiling the water, the carbon dioxide in solution is driven off, and the bicarbonate is converted into the insoluble normal carbonate, $CaCO_3$, which is precipitated in a fine crystalline powder.

c. Water of crystallization. Many substances, in the act of crystallizing, combine with water, and the water, so combined, is termed *water of crystallization* or *water of hydration.* The same substance does not always contain the same number of molecules of water of crystallization. Sodium carbonate, for example, may contain 10 H_2O (dekahydrate) or 1 H_2O (monohydrate); under certain conditions, it may be made to crystallize with 8 H_2O or even 5 H_2O. Crystals containing water of crystallization frequently lose part, but rarely all, of it on exposure to the air for some time. In doing so, they lose their characteristic transparency, first becoming somewhat opaque and then finally crumbling, thereby losing their crystalline form. This change is termed *efflorescence.*

Water of crystallization must be distinguished from *interstitial water* (water of decrepitation), which is water held mechanically in the interstices of crystals; this occurs particularly where the crystals are large and have been formed rapidly.

A substance is said to be *hygroscopic*, if it absorbs water from the atmosphere; if it dissolves in the water so absorbed, it is said to be *deliquescent.*

CHAPTER 4

CLASSES OF PHARMACEUTICAL PREPARATIONS

Section I. WATERS (AQUAE)

48. DEFINITION. Waters are aqueous solutions of volatile substances. Aromatic waters are solutions, usually saturated, of volatile oils or other aromatic volatile substances in distilled water.

49. DESCRIPTION. Waters are brilliant, colorless liquids having the odor and taste of the dissolved volatile substance and the density and viscosity of distilled water.

50. GENERAL USES. Waters are generally used as vehicles.

51. METHODS OF PREPARATION. The general methods are those indicated in the official processes for preparing aromatic waters.

52. OFFICIAL PROCESSES FOR AROMATIC WATERS. Aromatic waters are prepared by the following U.S.P. general processes:

a. Distillation. Place the odoriferous portion of the plant or drug from which the aromatic water is to be prepared in a suitable still with sufficient distilled water, and distill most of the water, carefully avoiding the development of empyreumatic odors through the charring or scorching of the substances. Separate the excess of oil and preserve or use the clear aqueous portion, filtered if necessary.

b. Solution.

The volatile oil or other specified volatile substance...	2 cc. or 2 Gm.
Distilled water, a sufficient quantity.....	
To make.....	1000 cc.

Shake the volatile substance (suitably comminuted if a solid) with 1000 cc. of distilled water in a capacious bottle, and repeat the shaking several times during a period of about 15 minutes. Set the mixture aside for 12 hours or overnight, filter through wetted filter paper, and pass enough distilled water through the filter to make the product measure 1000 cc.

c. Alternative solution method. The following method of preparing aromatic waters by solution is alternative with the method just prescribed. Thoroughly incorporate the volatile oil (or the suitably comminuted volatile solid) with 15 Gm. of purified talc or with a sufficient quantity of purified siliceous earth or pulped filter paper. Add 1000 cc. of distilled water and thoroughly agitate the mixture several times during 10 minutes. Then filter the mixture, returning the first portions, if necessary, to obtain a clear filtrate and add enough distilled water through the filter to make the product measure 1000 cc.

53. TYPICAL EXAMPLES. Among the many typical examples of official waters prepared by the general processes are the following: Anise Water, Cinnamon Water, and Peppermint Water.

54. EXCEPTIONS. The following official waters are exceptions in that they are not prepared by the general processes:

a. Chloroform Water, U.S.P., prepared as follows: Chloroform, distilled water; of each a sufficient quantity. To a convenient quantity of distilled water contained in a dark amber-colored bottle, add enough chloroform to maintain a slight excess after the mixture has been repeatedly and thoroughly agitated, taking care that there is always an excess of chloroform present. When chloroform water is to be dispensed, decant the quantity required from the separated chloroform.

b. Distilled Water, U.S.P., prepared by purifying water by distillation.

c. Sterilized Distilled Water, U.S.P., prepared by sterilizing distilled water and protecting it from contamination.

d. Water for Injection, U.S.P., prepared by distilling and sterilizing water freshly in such a manner that it is free from pyrogens.

e. Rose Water, U.S.P., prepared by diluting the Stronger Rose Water with an equal volume of distilled water.

f. Bitter Almond Water, N.F., prepared by dissolving 1 cc. of oil of bitter almond in enough distilled water to make 1000 cc.

g. Hamamelis Water, N.F., prepared as follows: Macerate recently cut and partially dried dormant twigs of *Hamamelis virginiana* for about 24 hours in about twice their weight of water; then distill until not more than 850 cc. of distillate is obtained for each 1000 Gm. of the twigs taken; add 150 cc. of alcohol to each 850 cc. of distillate; mix thoroughly.

h. Phenolated Water, N.F., prepared by mixing 22 cc. of liquefied phenol with enough distilled water to make 1000 cc.

i. Redistilled Water, N.F., a specially distilled water originally intended for use in ampuls but now largely displaced for that purpose by Water for Injection, U.S.P.

Section II. SOLUTIONS (LIQUORES)

55. DEFINITION. The title, solution, as used for an official class of preparations is applied, with few exceptions, to aqueous solutions of nonvolatile substances. Each of these solutions has a concentration that has been established through tradition and use.

56. DESCRIPTION. The official solutions vary greatly in color, density, and viscosity, according to the nature of the solutes. All of them are transparent and in most cases they are brilliant.

57. GENERAL USES. There are no general uses for the official solutions; the use of each is determined by its respective ingredients.

58. METHODS OF PREPARATION. There are no general methods for the preparation of the official solutions; each is prepared by a process appropriate for the particular substances involved. In many cases simple solution, or the addition of the substances directly to the solvent, is employed; in other cases the substances to be dissolved are formed in the process of manufacture as the result of chemical action.

59. TYPICAL EXAMPLES. The formula of each of the following list of typical official solutions may be found in appendix III under the name of the principal ingredient of the respective solution.

Selected list of solutions from the U.S.P. XII:

Solution of arsenious acid.
Solution of amaranth.
Solution of ammonia, diluted.
Solution of ammonia, strong.
Solution of calcium hydroxide.
Solution of three chlorides, isotonic.
Solution of chloroazodin.
Solution of cresol, saponated.
Solution of epinephrine hydrochloride.
Solution of formaldehyde.
Solution of hydrogen peroxide.
Solution of iodine.
Solution of iodine, strong.
Solution of magnesium citrate.
Solution of potassium arsenite.
Solution of sodium chloride, isotonic.

Selected list of solutions from the N.F. VII:

Solution of boric acid.
Solution of aluminum acetate.
Solution of ephedrine sulfate.
Solution of merbromin, surgical.
Solution of coal tar.
Solution of potassium iodide.
Solution of sodium borate, compound.
Solution of sodium hypochlorite, diluted.

Section III. EMULSIONS (EMULSA)

60. DEFINITION. An emulsion is a heterogeneous system consisting of two liquid phases, one of which is dispersed as minute droplets in the other. The liquid which is broken up into minute droplets is known as the dispersed, discontinuous, or internal phase; the liquid surrounding the droplets is known as the dispersion medium, the continuous phase, or the external phase. Usually one of the phases is an oil and the other is water. If the internal phase is the oil, the emulsion is termed an oil-in-water or o/w emulsion. If the internal phase is aqueous, the emulsion is termed a water-in-oil or w/o emulsion. The typical pharmaceutical emulsion is of the oil-in-water type.

61. DESCRIPTION. Pharmaceutical emulsions are usually somewhat viscid and resemble milk, which is a natural emulsion.

62. GENERAL USES. Emulsions serve as a means of presenting more palatable mixtures of oils and aqueous solutions and of insuring uniformity of dosage of such mixtures. The oil-in-water emulsions are more readily miscible with the contents of the intestines than are the oils, which may be advantageous.

63. METHODS OF PREPARATION. The emulsifying agents employed determine the method to be used in preparing emulsions. Acacia is the most common emulsifying agent in oil-in-water emulsions. There are two general methods of preparing an emulsion when acacia is employed. The more common is known as the Continental method and the other, the English method.

a. Continental method. In this method, 1 Gm. of finely powdered acacia is thoroughly mixed in a clean, dry mortar or bottle with each 4 cc. of fixed oil, or 2 cc. of volatile oil, to be emulsified. Then 2 cc. of water for each 1 Gm. of acacia is added *all at once* and the mixture promptly and thoroughly triturated or agitated until a thick, white primary emulsion is formed. This is then diluted to the desired volume.

b. English method. In this method a mucilage is prepared by adding water to granulated acacia and triturating it until the acacia is dissolved. The oil is then added in small portions, triturating after each addition, adding small quantities of water from time to time as necessary to form the emulsion.

c. Other emulsifying agents such as tragacanth, agar, egg yolk, and gelatin require special methods for use in each case.

64. TYPICAL EXAMPLES. The formula of each of the following typical official emulsions may be found in Appendix III under the name of the principal ingredient of the respective emulsion:

U.S.P. XII emulsions:

Emulsion of cod liver oil.
Emulsion of oil of turpentine.
Emulsion of liquid petrolatum.

Section IV. SYRUPS (SYRUPI)

65. DEFINITION. Syrups are concentrated aqueous solutions of sucrose containing flavoring or medicinal substances.

66. GENERAL USES. Many of the syrups are used as vehicles. Their viscosity and sweet taste cause them to be a preferred form for the administration of some drugs, particularly the expectorants.

67. METHODS OF PREPARATION. There are two general methods for the preparation of syrups:

a. Adding sucrose to a specially prepared solution or extraction of the medicinal agent.

b. Adding the medicinal agent to simple syrup.

In preparing syrups, the sucrose may be dissolved with the aid of heat, by agitation, or by percolation. The process to be used depends on the ingredients of the syrup and the time available for completing its manufacture.

68. TYPICAL EXAMPLES. The following official syrups are typical of the class:

Selected list of syrups from the U.S.P. XII:

Syrup (simple).
Syrup of citric acid.
Syrup of hydriodic acid.
Syrup of orange.
Syrup of tolu balsam.
Syrup of ipecac.
Syrup of wild cherry.
Syrup of sarsaparilla, compound.

Selected list of syrups from the N.F. VII:

Syrup of cherry.
Syrup of squill.

Section V. MUCILAGES (MUCILAGINES)

69. DEFINITION. Mucilages are liquid or semisolid solutions or suspensions of gums or mucilaginous substances in water.

70. DESCRIPTION. Mucilages are transparent or translucent, viscid liquids or semisolids, usually pale yellowish or almost colorless.

71. GENERAL USES. Mucilages are used as demulcents, emollients, lubricants, and pharmaceutical suspending agents.

72. METHODS OF PREPARATION. There are no general methods for the preparation of mucilages; each is prepared by a process appropriate for the particular substances involved.

73. TYPICAL EXAMPLES. The following mucilages are typical official examples of the class:

U.S.P. XII mucilages:
- Mucilage of Acacia.
- Mucilage of Tragacanth.

N.F. VII mucilage:
- Mucilage of Chondrus.

Section VI. MIXTURES (MISTURAE)

74. DEFINITION. Mixtures are aqueous preparations containing insoluble substances intended for internal use.

75. DESCRIPTION. Mixtures are usually opaque liquids requiring agitation to disperse the insoluble material throughout the liquid portion before pouring. Their color varies with the nature of the ingredients.

76. GENERAL USES. There are no general uses for mixtures; the use of each is determined by its respective ingredients.

77. METHODS OF PREPARATION. There are no general methods for the preparation of mixtures; each is prepared by a process appropriate for the particular substances involved. In each case the objective is to have the insoluble material in very fine particles so that it may be dispersed readily by agitation.

78. TYPICAL EXAMPLES. The following official mixtures are typical of the class:

U.S.P. XII mixture:
- Chalk mixture.

Selected list of mixtures, N.F. VII:
- Mixture of opium and glycyrrhiza, compound.
- Mixture of rhubarb and soda.
- Expectorant mixture.

Section VII. MAGMAS (MAGMATA)

79. DEFINITION. Magmas are liquid preparations resembling mixtures, in which the insoluble substances are usually precipitated in a very fine state of subdivision and remain in suspension for a considerable length of time.

80. DESCRIPTION. Magmas are rather viscid liquids and often resemble cream or milk.

81. GENERAL USES. There are no general uses for magmas; the use of each is determined by its respective ingredients.

82. METHODS OF PREPARATION. Precipitation in a manner producing very fine particles is the general method of preparing magmas. An exception is Magma of Bentonite which is prepared by maceration.

83. TYPICAL EXAMPLES. The following official magmas are typical examples of the class:

U.S.P. XII magma:

Magnesia magma.

N.F. VII magmas:

Magma of bentonite.

Magma of bismuth.

Section VIII. LOTIONS (LOTIONES)

84. DEFINITION. Lotions are liquid preparations, usually aqueous, containing insoluble substances intended for external application.

85. DESCRIPTION. Lotions vary greatly in color and viscosity according to the nature of the ingredients.

86. GENERAL USES. There are no general uses for lotions; the use of each is determined by its respective ingredients.

87. METHODS OF PREPARATION. Precipitation, hydration, and prolonged trituration are the processes used in preparing lotions so that the particle size of the insoluble portion will be very small. The nature of the ingredients determines which process is to be employed.

88. TYPICAL EXAMPLES. The following are typical official examples of the class:

Selected list of N.F. VII lotions:

Calamine lotion.

Calamine lotion, phenolated.

White lotion.

Section IX. GLYCERITES (GLYCERITA)

89. DEFINITION. Glycerites are liquid or semisolid solutions of medicinal substances in glycerin.

90. DESCRIPTION. Glycerites are either viscid liquids or semisolids. They are hygroscopic and either transparent or translucent.

91. GENERAL USES. Glycerites are employed as convenient stable solutions of the respective drugs which may readily be diluted with water.

92. METHODS OF PREPARATION. There are no general methods for the preparation of glycerites; each is prepared by a process appropriate for the particular substances involved.

93. TYPICAL EXAMPLES. The formula of each of the following typical official glycerites may be found in appendix III under the name of the principal ingredient of the respective glycerite:

U.S.P. XII glycerites:

Glycerite of tannic acid.
Glycerite of starch.
Glycerite of boroglycerin.

Section X. SPIRITS (SPIRITUS)

94. DEFINITION. Spirits are alcoholic solutions of volatile substances.

95. DESCRIPTION. Spirits are brilliant liquids having the characteristic odor and color of the dissolved volatile substances.

96. GENERAL USES. There are no general uses for the spirits; the use of each is determined by its respective ingredients.

97. METHODS OF PREPARATION. Most of the spirits are prepared by simple solution; a few involve simple solution and maceration; a few are prepared by distillation. For any spirit of a volatile oil, for which no specific formula is provided, the general formula of the National Formulary VII may be followed. It directs that 65 cc of the volatile oil be dissolved in enough alcohol to make 1000 cc of the spirit.

98. TYPICAL EXAMPLES. The following official spirits are typical examples of the class:

Selected list of spirits, U.S.P. XII:

Spirit of ammonia, aromatic.
Spirit of orange, compound.
Spirit of camphor.
Whisky.
Spirit of peppermint.
Brandy.

Selected list of spirits, N.F. VII:

Spirit of ethyl nitrite.
Spirit of chloroform.
Spirit of myrcia, compound.

Section XI. ELIXIRS (ELIXIRIA)

99. DEFINITION. Elixirs are aromatic, sweetened, hydroalcoholic solutions.

100. DESCRIPTION. Elixirs are brilliant liquids having an aromatic odor and pleasant taste. The color of elixirs varies according to the nature of the ingredients; some are artificially colored.

101. GENERAL USES. Used internally, elixirs vary in use according to the ingredients. Many of them are used as vehicles.

102. METHODS OF PREPARATION. Simple solution is the general process employed in preparing elixirs. They are clarified by filtration through talc or a similar agent until brilliantly clear.

103. TYPICAL EXAMPLES. The following official elixirs are typical examples of the class:

U.S.P. XII elixirs:
- Aromatic elixir.
- Elixir of phenobarbital.

Selected list of elixirs, N.F. VII:
- Elixir of three bromides.
- Elixir of pepsin, compound.
- Elixir of potassium bromide.
- Elixir of terpin hydrate.
- Elixir of terpin hydrate and codeine.

Section XII. COLLODIONS (COLLODIA)

104. DEFINITION. Collodions are liquid preparations having as their base or vehicle a solution of pyroxylin in a mixture of ethyl oxide and alcohol.

105. DESCRIPTION. Collodions are transparent liquids having the odor of ether. They volatilize rapidly when exposed to the air, first thickening and then solidifying. They are not miscible with water.

106. GENERAL USES. Collodions are used for local, external application, the evaporation of the solvent leaving a protective film and localizing the action of any drug contained in it. The escharotic drugs are those most commonly used in a collodion vehicle.

107. METHODS OF PREPARATION. Collodions are prepared by simple solution, avoiding moisture and exposure to open flame.

108. TYPICAL EXAMPLES. The following official collodions are typical examples of the class:

Collodions, U.S.P. XII:
- Collodion.
- Flexible collodion.

Collodion, N.F. VII:
- Salicylic collodion.

Section XIII. LINIMENTS (LINIMENTA)

109. DEFINITION. Liniments are liquid or, rarely, semisolid preparations intended for external application. Usually they are of an oily or irritant nature and are applied with friction.

110. DESCRIPTION. Liniments vary greatly in color, viscosity and odor according to the nature of the ingredients.

111. GENERAL USES. Liniments are ordinarily used as vehicles for drugs which act as counterirritants or anodynes.

112. METHODS OF PREPARATION. There are no general methods for the preparation of liniments; each is prepared by a process appropriate for the particular substances involved. Many of them are prepared by simple solution.

113. TYPICAL EXAMPLES. The following official liniments are typical examples of the class:

Liniments, U.S.P. XII:

Camphor liniment.
Camphor and soap liniment.
Chloroform liniment.
Liniment of soft soap.

Section XIV. INFUSIONS (INFUSA)

114. DEFINITION. Infusions are aqueous preparations containing the water-soluble constituents of vegetable drugs, extracted by means of hot or cold water.

115. DESCRIPTION. Infusions are liquid preparations resembling the beverage, tea, which is ordinarily made by infusion. They should be prepared freshly. Their color varies with the nature of the drug extracted.

116. GENERAL USES. There are no general uses for infusions; the use of each is determined by its respective ingredients.

117. METHODS OF PREPARATION. Unless otherwise specified, infusions are prepared by the following general formula:

The drug, coarsely comminuted	50 Gm.
Distilled water, to make	1000 cc.

Moisten the drug, in an earthenware vessel, provided with a cover, with 50 cc. of cold distilled water, and allow it to stand for 15 minutes. Then add 900 cc. of boiling distilled water, cover the vessel tightly, and allow it to stand for 30 minutes. Then strain the mixture and pass enough distilled water through the strainer to make the infusion measure 1000 cc. If the activity of the infusion is affected by the temperature of boiling water, only cold distilled water should be used.

Caution: The drug concentration of an infusion representing a potent drug should be specified by the physician.

118. TYPICAL EXAMPLES. There are no official examples of infusions prepared by this general process.

Section XV. TINCTURES (TINCTURAE)

119. DEFINITION. Tinctures are alcoholic liquid preparations of vegetable or animal drugs or, in a few instances, of chemicals, and so prepared that each tincture contains the therapeutic constituents from a definite quantity of the drug or chemical.

120. DESCRIPTION. Tinctures are transparent liquids varying in color according to the nature of the drugs from which they are extracted.

121. GENERAL USES. There are no general uses for tinctures; the use of each is determined by its respective constituents.

122. METHODS OF PREPARATION. Tinctures are prepared by percolation (Process P), by maceration (Process M), by solution, or by dilution of the respective fluidextract. They are usually made so that for potent drugs, each 100 cc of the tincture represents 10 Gm of the drug; for less potent drugs, each 100 cc of the tincture represents 20 Gm of the drug; for fresh drugs, each 100 cc of the tincture represents 50 Gm of the fresh drug.

123. TYPICAL EXAMPLES. The following official tinctures are typical examples of the class:

Selected list of tinctures, U.S.P. XII:

Tincture of sweet orange peel.
Tincture of tolu balsam.
Tincture of belladonna.
Tincture of benzoin.
Tincture of benzoin, compound.
Tincture of digitalis.
Tincture of gentian, compound.
Tincture of hyoscyamus.
Tincture of iodine.
Tincture of iodine, mild.
Tincture of nux vomica.
Tincture of opium.
Tincture of opium, camphorated.

Selected list of tinctures, N.F. VII:

Tincture of cudbear.
Tincture of ferric chloride.
Tincture of vanilla.

Section XVI. VINEGARS (ACETA)

124. DEFINITION. Vinegars are liquid preparations resembling tinctures in which the drug is extracted with a menstruum of diluted acetic acid.

125. DESCRIPTION. Vinegars are transparent liquids having the odor of acetic acid. Their color varies according to the nature of the drug extracted.

126. GENERAL USES. There are no general uses for vinegars; the use of each is determined by its respective constituents.

127. METHODS OF PREPARATION. Vinegars are prepared by maceration.

128. TYPICAL EXAMPLE. The following official vinegar is typical of the class: Vinegar of squill, N.F. VII.

Section XVII. FLUIDEXTRACTS (FLUIDEXTRACTA)

129. DEFINITION. Fluidextracts are liquid preparations of vegetable drugs, containing alcohol as a solvent or preservative, and so prepared that each 1 cc of the fluidextract contains the therapeutically active or important constituents of 1 Gm of the drug.

130. DESCRIPTION. Fluidextracts are dark colored liquids.

131. GENERAL USES. There are no general uses for fluidextracts; the use of each is determined by its respective constituents. Fluidextracts serve as a convenient, stable form of the drug.

132. METHODS OF PREPARATION. Fluidextracts are prepared by percolation according to the following processes: Process A, percolation with one alcoholic menstruum; Process B, percolation with two menstrua; Process C, fractional or divided percolation; Process D, extraction with water; and Process E, pressure percolation.

133. TYPICAL EXAMPLES. The following official fluidextracts are typical examples of the class:

Selected list of fluidextracts, U.S.P. XII:

Fluidextract of cascara sagrada.
Fluidextract of cascara sagrada, aromatic.
Fluidextract of ergot.

Section XVIII. OLEORESINS (OLEORESINAE)

134. DEFINITION. Pharmaceutical oleoresins are liquid preparations of drugs containing volatile oils and resins, obtained by extraction of the drugs with ether, acetone or alcohol, and subsequent distillation of the solvent from the dissolved oleoresins.

135. DESCRIPTION. Pharmaceutical oleoresins are viscid liquids. Their color depends on the nature of the drugs extracted.

136. GENERAL USES. There are no general uses for the pharmaceutical oleoresins; the use of each is determined by its respective constituents.

137. METHODS OF PREPARATION. Pharmaceutical oleoresins are prepared by percolation and subsequent evaporation of the volatile solvent from the percolate.

138. TYPICAL EXAMPLES. The following official oleoresin is a typical example of the class: Oleoresin of aspidium, U.S.P. XII.

Section XIX. EXTRACTS (EXTRACTA)

139. DEFINITION. Extracts are concentrated preparations of vegetable or animal drugs obtained by extracting the active constituents of the respective drugs with suitable menstrua, evaporating all or nearly all of the solvent and adjusting the residual masses or powders to the prescribed standards.

140. DESCRIPTION. Extracts are in three forms: dry powders, known as powdered extracts; plastic masses, known as pilular extracts; and semi-liquids or those of syrupy consistence.

141. GENERAL USES. There are no general uses for extracts; the use of each is determined by its respective constituents.

142. METHODS OF PREPARATION. Extracts are prepared by percolation and subsequent evaporation of the percolate. The product is then adjusted to prescribed standards by the addition of suitable diluents.

143. TYPICAL EXAMPLES. The following official extracts are typical of the class:

Selected list of extracts, U.S.P. XII:

Extract of belladonna.
Extract of cascara sagrada.
Extract of glycyrrhiza.
Extract of glycyrrhiza, pure.
Extract of hyoscyamus.
Extract of malt.

Section XX. POWDERS (PULVERES)

144. DEFINITION. Powders are intimate mixtures of medicinal substances in dry, pulverized form.

145. DESCRIPTION. Powders vary in color according to the nature of their ingredients. They may be in undivided bulk form or in divided dosages in papers.

146. GENERAL USES. There are no general uses for powders; the use of each is determined by its respective ingredients.

147. METHODS OF PREPARATION. Powders are generally mixed by placing the most potent of the ingredients in a mortar, adding about an equal quantity of a less potent ingredient, and triturating thoroughly. Then successive portions of less potent ingredients are added and the trituration continued until the product is of uniform fineness. A sieve may be used to insure uniformity in fineness. If the powder is to be in divided dosages, the quantity indicated for each dosage is weighed and placed on a paper. The paper is then folded, inclosing the powder.

148. TYPICAL EXAMPLES. The following powders are typical official examples of the class:

Divided powders:

Compound effervescent powders, U.S.P. XII.

Undivided powders:

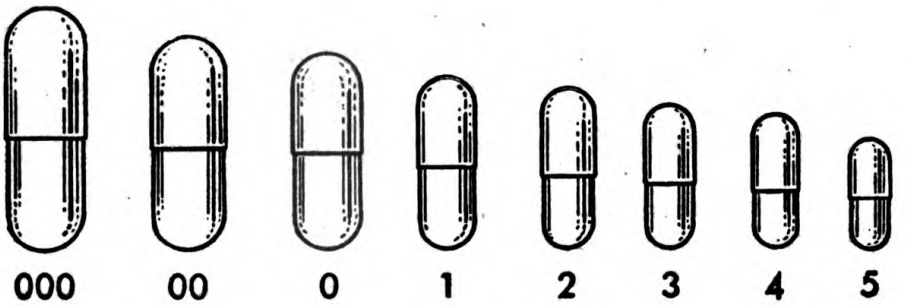
Powder of ipecac and opium, N.F. VII.
Compound chalk powder, U.S.P. XII.

Section XXI. CAPSULES (CAPSULAE)

149. DEFINITION. Capsules are individual doses of medicine inclosed in cases usually made of gelatin.

150. DESCRIPTION. The most common type of capsules is that in which the medicine in the form of a dry powder is inclosed in colorless, transparent cases made of hard gelatin. These are in sizes universally designated by the numbers, 5, 4, 3, 2, 1, 0, 00, and 000, with the No. 5 having a capacity of about one grain of acetylsalicylic acid or other substance of similar density, and the No. 000 having a capacity of about fifteen grains.

A second type is made of soft gelatin and commonly incloses oils.



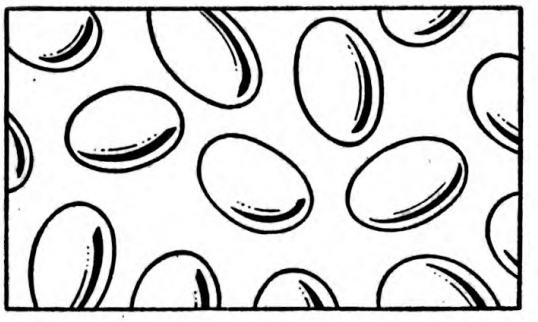


Figure 20. Capsules.

A third type is made from starch and is commonly called a konseal, cachet, or wafer.

151. GENERAL USES. The capsule is a popular form of administering medicines because it masks the taste and releases the medicine promptly in the stomach.

152. METHODS OF PREPARATION. In preparing hard gelatin capsules, the ingredients are thoroughly mixed as indicated under Powders. The smallest size of empty capsule which will hold the dosage of medicine conveniently is selected. One empty capsule is placed on the right-hand balance pan with the weights for the contents of one capsule. The cap is removed from an empty capsule and the body of it, held between thumb and forefinger, is filled by pressing it into a layer of the medicine on a flat surface such as a pill tile. When the body of the capsule is filled, the cap is replaced and the whole is put on the left-hand balance pan, checking the weight of its contents. If too little or too much of the medicine has been inclosed, the cap is removed and the proper adjustment made. This process is continued until the desired number are filled. They are then placed in a clean, dry towel and shaken carefully to remove any medicine adhering to the surface of the capsule.

In filling hard gelatin capsules with oils a pipette is used and the capsule is sealed by moistening the cap before putting it on the body of the capsule. It may be moistened by pressing it against a piece of moist absorbent cotton.

Soft gelatin capsules are filled by rather complicated machines at the plants of pharmaceutical manufacturers.

153. TYPICAL EXAMPLES. The following official capsules are typical examples of the class:

Selected list of capsules, U.S.P. XII:

Digitalis capsules.
Halibut liver oil capsules.
Pentobarbital sodium capsules.

Section XXII. TRITURATIONS (TRITURATIONES)

154. DEFINITION. Triturations are dilutions of potent substances in the form of fine powders.

155. DESCRIPTION. Triturations are dry, fine, white- or light-colored powders.

156. GENERAL USE. The general use of a trituration is to insure adequate accuracy and uniformity of dosage of potent substances.

157. METHODS OF PREPARATION. Unless otherwise directed, triturations are prepared by the following official general formula:

The medicinal substance	10 Gm.
Lactose, in moderately fine powder	90 Gm.

Place the medicinal substance, previously reduced, if necessary, to a moderately fine powder, in a mortar. Add about an equal volume of the lactose and triturate the powders thoroughly. Then add successive portions of the lactose, triturating the mixture thoroughly after each addition until the medicinal substance is intimately mixed with the lactose and reduced to a fine powder.

158. TYPICAL EXAMPLES. The following unofficial triturates are typical examples of the class:

Trituration of atropine sulfate.
Trituration of strychnine sulfate.

Section XXIII. PILLS (PILULAE)

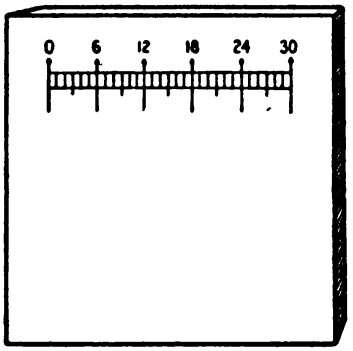
159. DEFINITION. Pills are spherical or ovoid masses of medicinal substances intended for administration by mouth.

160. DESCRIPTION. Pills usually weigh from 0.05 Gm. to 0.5 Gm. and frequently are coated with gelatin or colored sucrose.

161. GENERAL USES. Because they are compact and easily swallowed, pills are used in administering relatively potent substances, but they have been replaced to a great extent by tablets.

162. METHODS OF PREPARATION. The first step in making pills is to prepare the mass. This is accomplished by mixing the ingredients thoroughly as described under Powders and then adding enough of an excipient such as liquid glucose to form a plastic mass when it is triturated with the ingredients. The second step in the process is the division of the mass. It is divided into the individual dosages by rolling it into a cylinder

and cutting this cylinder or "pipe" into a number of equal segments corresponding to the number of pills to be made. The third and final step is the finishing of the pills, making them into spherical or ovoid form. This is done by rotating the segments between the thumb and finger until nearly spherical and then rolling them under a disc known as a pill finisher until they are very smooth and of uniform shape.



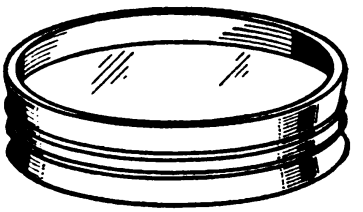


Figure 21. Devices used in making pills.

163. TYPICAL EXAMPLES. The following official pills are typical of the class:

Pills of ferrous carbonate, U.S.P. XII.
Compound pills of mild mercurous chloride, N.F. VII.

Section XXIV. TABLETS (TABELLAE)

164. DEFINITION. Tablets are molded or compressed masses of medicinal substances, usually in discoid form.

165. DESCRIPTION. Tablets usually weigh from 0.05 Gm. to 1 Gm., with about 0.3 Gm. being the most common size. Molded tablets, commonly known as tablet triturates, are discoid, uncoated, and weigh about 0.05 Gm. They are composed of one or more potent substances in a vehicle of lactose and sucrose. Compressed tablets are double-convex, discoid, and contain only the medicinal substances with a small quantity of a disintegrating agent. They may be coated.

166. GENERAL USES. Tablets can be made very economically by the manufacturer; they are a convenient dosage form for patient; and they disintegrate readily in the stomach so that rapid action of the medicine is possible. These advantages have caused tablets to be used as the popular dosage form of a wide variety of medicinal substances.

167. METHODS OF PREPARATION. Molded tablets are prepared by mixing the finely powdered medicinal substances with a vehicle composed of about 90 percent of lactose and 10 percent of sucrose. This mixture is thoroughly moistened with diluted alcohol and pressed into the holes of a perforated plate or die. The die is placed on a base studded with pegs which eject the material from the die in the discoid form of the tablet. It is then allowed to dry and harden. If the tablet is to be used for making a solution for parenteral use it is called a hypodermic tablet and its vehicle must be a special lactose or other substance which will dissolve readily and completely.

Compressed tablets are prepared by placing the medicinal substances in granular form into a machine consisting of one or more dies and punches which compress the material into the desired form. These may then be coated or may be used uncoated.

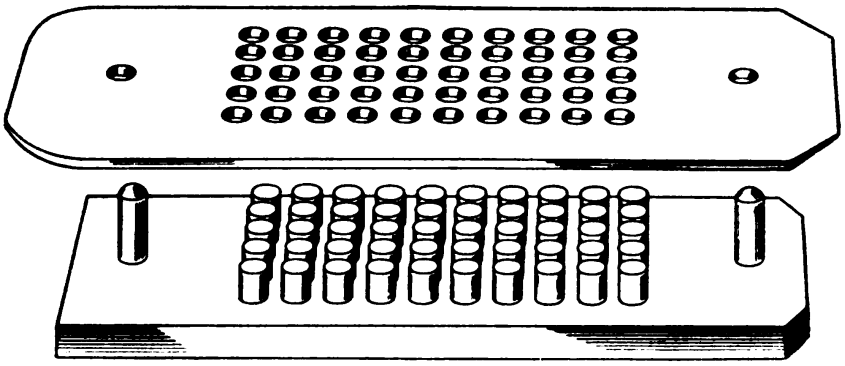


Figure 22. Tablet triturate mold.

168. TYPICAL EXAMPLES. The following official tablets are typical examples of the class:

Selected list of tablets, U.S.P. XII:

Acetophenetidin tablets.
Acetylsalicylic acid tablets.
Atropine sulfate tablets.
Nicotinic acid tablets.
Codeine sulfate tablets.
Digitalis tablets.
Morphine sulfate tablets.
Strychnine sulfate tablets.
Sulfanilamide tablets.
Sulfapyridine tablets.
Sulfathiazole tablets.
Thiamine hydrochloride tablets.
Thyroid tablets.
Poison tablets of mercury bichloride, large.
Poison tablets of mercury bichloride, small.

Section XXV. OINTMENTS (UNGUENTA)

169. DEFINITION. Ointments are semisolid fatty or oily preparations of such a consistency as to be easily applied to the skin, gradually liquefying when in contact with it.

170. DESCRIPTION. Ointments vary in color according to the nature of their ingredients. The vehicle of an ointment is generally of a greasy character and the medicinal substances combined with it are always intended to be in very fine particles, uniformly distributed.

171. GENERAL USES. For the external application of medicinal substances, ointments have long been a preferred form. In addition to the action of the medicinal substances combined with them, the fatty vehicles are emollient and protective and, therefore, valuable in the many cases where such action is advantageous.

172. METHODS OF PREPARATION. Ointments are prepared by the following processes: simple mechanical incorporation, solution, emulsification, levigation, and fusion. A special technique is required for each process in order that the finished product may be satisfactory.

173. TYPICAL EXAMPLES. The following official ointments are typical examples of the class:

Ointments, U.S.P. XII:

- Boric acid ointment.
- Tannic acid ointment.
- Ethyl aminobenzoate ointment.
- White ointment.
- Yellow ointment.
- Rose water ointment.
- Belladonna ointment.
- Chrysarobin ointment.
- Ammoniated mercury ointment.
- Strong mercurial ointment.
- Mild mercurial ointment.
- Yellow mercuric oxide ointment.
- Iodine ointment.
- Phenol ointment.
- Pine tar ointment.
- Sulfur ointment.
- Zinc oxide ointment.

Selected list of ointments, N.F. VII:

- Ointment of benzoic and salicylic acids.
- Ointment of mild mercurous chloride.
- Ointment of ichthammol.

Section XXVI. PASTES (PASTAE)

174. DEFINITION. Pastes are preparations of medicinal substances made into adhesive, plastic form with vehicles such as soaps, pectin, and, in some cases, petrolatum.

175. DESCRIPTION. Pastes vary greatly in appearance according to the nature of their ingredients. Many of them are very firm semisolids resembling ointments having a high percentage of medicinal substances.

176. GENERAL USES. Dermatologists use pastes in many cases where both protective action and a high concentration of the medicinal substances are desired.

177. METHODS OF PREPARATION. Pastes are prepared by the processes used in making ointments. Levigation is usually involved.

178. TYPICAL EXAMPLES. The following official pastes are typical of the class:

Selected list of pastes, N.F. VII:

- Acetylsalicylic acid paste, compound.
- Pectin paste.
- Pectin paste, thin.
- Zinc oxide paste.
- Zinc oxide paste with salicylic acid.

Section XXVII. SUPPOSITORIES (SUPPOSITORIA)

179. DEFINITION. Suppositories are solid bodies adapted for introduction into different orifices of the human body, and melting, softening, or dissolving at body temperature.

180. DESCRIPTION. Suppositories are usually of the following types, weights, and shapes: rectal, 2 Gm., tapered; vaginal, 4 to 10 Gm., globular or oviform; urethral, 2 to 4 Gm., pencil-shaped. Theobroma oil and glycerinated gelatin are the most common vehicles for suppositories.

181. GENERAL USES. For the local application of medicinal substances, as in hemorrhoids, suppositories are commonly used. Occasionally, suppositories are used in administering medicinal substances when administration by mouth is not practicable.

182. METHODS OF PREPARATION. For suppositories made with theobroma oil, the medicinal substances in fine particles are mixed thoroughly with about an equal weight of grated theobroma oil and then the remainder of the theobroma oil is incorporated and the mixture triturated until a plastic mass is formed. The mass is rolled into a cylinder of the proper length and divided into the required number of equal parts which are then formed into the desired shape.

If the process of cold compression is preferred, the mass instead of being rolled into a cylinder is placed in a special compressor which forms it into suppositories of the desired shape.

If the process of fusion is preferred, the medicinal substances are mixed as before and then incorporated with the remainder of the theobroma oil which has previously been melted. When the mixture has cooled to 38° C. and is about to congeal, it is poured into cooled molds and kept well-cooled until the suppositories have hardened, when they may be removed from the molds.

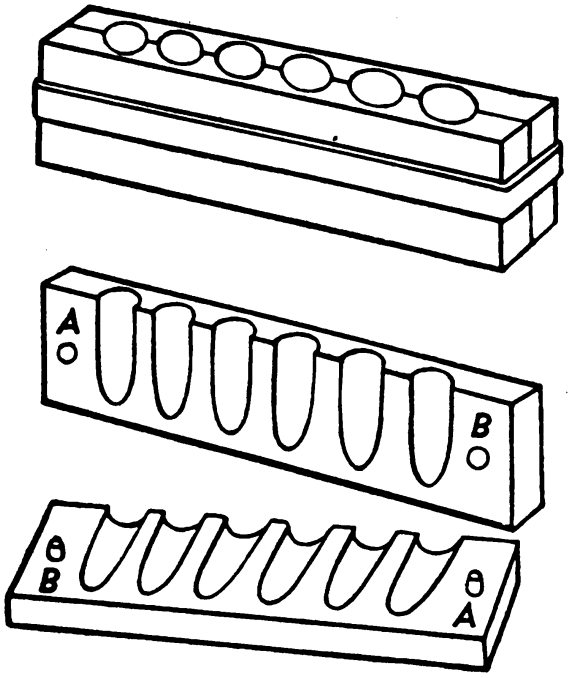


Figure. 23. Suppository mold.

For suppositories made with glycerinated gelatin, the medicinal substance, if solid and soluble in distilled water or glycerin, or if a miscible liquid, is mixed with a little distilled water and sufficient glycerin added to make the weight of the mixture one-half that of the finished mass. An equal weight of melted glycerinated gelatin is thoroughly incorporated with it and the mixture is poured into molds and cooled. If the medicinal substances are insoluble in water or glycerin, they are thoroughly triturated with sufficient glycerin to make the weight of the mixture one-half that of the finished mass and then the process completed as above described.

183. TYPICAL EXAMPLES. The following suppositories are typical examples of the class:

Tannic acid suppositories.
Suppositories of boroglycerin, N.F. VII.

Section XXVIII. PLASTERS (EMPLASTRA)

184. DEFINITION. Plasters are solid preparations intended for external application and adhesive at body temperature.

185. DESCRIPTION. Plasters consist of a mixture having pressure-sensitive adhesive properties, spread evenly upon fabric, the back of which may be coated with a water-repellent film. They are dispensed in rolls of varying lengths and widths on spools, or in sheets protected by paper folders.

186. GENERAL USES. Plasters are used for protection of the skin against abrasion; for mechanical support; and for medicinal effect by slow absorption of the medicinal agent.

187. METHODS OF PREPARATION. Plasters are generally prepared by spreading the plaster mass evenly upon fabric. The mass is a mixture of rubber, resins, and waxes, with one or more fillers of absorbent powder, such as zinc oxide or starch, and with the specified medicinal agent, if any.

188. TYPICAL EXAMPLES. The following official plasters are typical of the class:

Adhesive plaster, U.S.P. XII.
Belladonna plaster, U.S.P. XII.

CHAPTER 5

TOXICOLOGY

189. DEFINITIONS. a. *Toxicology* is the branch of science which treats of the nature, properties, effects, identification, and antidotal treatment of poisons.

b. *Poisoning* may be *acute* or *chronic*. *Acute poisoning* is caused by taking an overdose of any drug or other toxic agent and the symptoms usually follow promptly after its ingestion. *Chronic poisoning* occurs when drugs are taken over a long period of time in excess of the patient's ability to tolerate them. The treatment of chronic poisoning will not be considered in this manual as it is not of an emergency nature.

c. *An antidote* is any measure or agent which will remove, prevent the absorption of, or counteract the physiologic effects of a poison.

190. DIAGNOSIS OF ACUTE POISONING. This type of poisoning is to be suspected whenever any person, previously in good health, suddenly becomes ill, with unconsciousness, convulsions, or intense nausea and vomiting. The diagnosis can often be confirmed by the history, the patient's stating that he has taken poison, or by finding unconsumed poison nearby. Corrosive poisons such as strong acids, alkalies, phenol, and mercuric chloride cause grey or white patches in mouth and throat. Phenol, ether, chloroform, alcohol, and some toxic gases may be identified by their odor. But often the diagnosis cannot be made by such simple means and first aid must always be given at once without waiting to identify the poison.

191. TREATMENT OF ACUTE POISONING BY THE PHARMACIST TECHNICIAN. a. The medical officer must be sent for immediately.

b. First aid must be applied by the pharmacist technician.

c. Separate the patient from the poison as fast as possible.

(1) If the poison has been inhaled, carry the patient into fresh air.

(2) If the poison has been swallowed, and if copious vomiting has not occurred already, vomiting should be induced by placing a finger down the throat, or by emetics such as warm water to which large amounts of sodium chloride or mustard have been added. Whether vomiting is induced or spontaneous, the washing of the stomach should be aided by having the patient, if conscious, drink large amounts of water between the bouts of vomiting. If a stomach tube is handy and one has experience in inserting it, this is the best method of washing out the stomach except when corrosive poisons have been taken.

(3) If a corrosive poison is on the skin or gets in the eye, wash it off repeatedly with large quantities of water. In the case of concentrated H_2SO_4 on the skin, it should be wiped off before washing.

d. Antidotes should be administered only when the poison has been identified and its antidote is known and is immediately available. This is seldom the case, so antidotes are of value only rarely. A list of those easily available follows; they should be washed out of the stomach after using by mouth:

For *strong acids*—weak alkalies such as magnesium oxide.
For *strong alkalies*—weak acids such as highly diluted HCl.
For *phenol*—equal parts water and glycerin, a vegetable oil.
For $HgCl_2$—eggs or milk.
For *iodine*—starch.

e. General measures. Put the subject at rest. If breathing stops or is depressed, pull the tongue forward and start artificial respiration. If the patient has convulsions, protect tongue by a gag between the teeth. If pulse is absent or weak, elevate the feet and legs. Do not overtreat the patient.

CHAPTER 6

VETERINARY PHARMACOLOGY

192. GENERAL. Essentially the same drugs are used in animals as are employed in man. The storage and compounding of these drugs is the same irrespective of their use in animals or man. The same methods of administration are employed.

In general, the action of a drug is the same for all species, but there are some noteworthy exceptions. Emetics frequently do not produce emesis in horses. Morphine and its derivatives, which act as sedatives in the human, cannot be depended upon to exhibit this action in the horse and always produces excitement in the cat. Dogs tolerate relatively larger doses of morphine, but smaller doses of strychnine, than do men. Purgatives require longer to act in the herbivora than in the carnivora or omnivora. However, the greatest and most important difference between the preparation of drugs intended for humans, and those drugs intended for animals, is in the dosage.

193. DOSAGE. This is influenced by many factors, especially:

a. Species. The size of the animal is the chief factor. The dosages given in the table below are those for an adult horse of average size. The dose for a dog will be roughly one-sixteenth that for a horse, but the size of the animal is of importance in accurately determining the required dosage.

b. Age. Young animals require less than do adults. The dose for a 1-year colt is about ⅓ the adult dose; a 2-year colt ½, and a 3-year colt ⅔ the adult dose.

c. Temperament. Nervous and high strung animals are believed by many people to be more susceptible to the action of certain drugs than phlegmatic ones, and consequently such animals may be given slightly smaller doses of active drugs.

d. Idiosyncrasy. Rarely an animal will be found which is more susceptible to the action of certain drugs than other animals. Similarly, an occasional animal may be found less susceptible. The cause of such idiosyncrasy is not known.

e. Nature of the disease. The action of drugs varies with the state of the body, or organ, acted upon. Therefore, disease may have a controlling influence on the dosage.

f. The preparation employed. The rate of absorption of a drug varies with the form in which it is given. As a rule, liquids are absorbed more rapidly than solids, alcoholic solutions more rapidly than aqueous, uncoated pills more rapidly than coated pills.

g. Time of administration. If given after meals, delay in emptying of the stomach may delay absorption of a drug. However, the stomachs of herbivora are rarely empty and, in such animals, the time of administration is of less importance.

h. Method of administration. The same methods are used for animals as are used for man, but a few differences should be noted. The oral

method presents more difficulty in animals, but they can be induced to swallow a powdered drug by mixing the drug with the animal's food, or by placing the drug in capsules, and adding the capsules to the animal's food, or by injecting capsules into the animal's throat. Liquid preparations may be added to the animal's water, or given with a syringe, or through a stomach tube.

Drugs are also given to animals by subcutaneous or intradermal injection, by intravenous injection, by rectum, and by inhalation. Drugs are also applied locally to the skin of animals. The preparation of drugs for these various forms of administration in animals does not differ from that employed for similar administration to man.

The strength and preparation of medicaments to be applied locally to the skin, mucous membranes, or eyes of animals do not differ materially from that used by man. The dosage of drugs commonly employed internally in horses is given in the table below:

Dosage of drugs commonly employed internally for adult horses
(Oral dose given unless otherwise stated.)

Acetanilid	15–30 grams.
Alcohol	30–60 cubic centimeters in 500 cubic centimeters water.
Aloes	45–75 grams in form of ball or in a capsule.
Ammonia, aromatic spirit	30–60 cubic centimeters in 500 cubic centimeters water.
Ammonium carbonate	10–25 grams in ball, solution, or mucilaginous drink.
Ammonium chloride	4–15 grams.
Arecoline hydrobromide	As cathartic, 30–60 milligrams subcutaneously, repeated once or twice at 15–30 minute intervals. In laminitis 30–60 milligrams daily.
Arsenic trioxide	0.2–0.3 gram, as solution of potassium arsenite 8–30 cubic centimeters.
Bismuth subcarbonate	4–15 grams.
Bismuth subnitrate	4–15 grams.
Camphor	4–15 grams.
Cannabis	As the extract, 2–8 grams; as the fluidextract, 16–30 cubic centimeters by mouth; intravenously, for narcosis, 5–10 cubic centimeters.
Chalk, prepared	30–60 grams.
Charcoal	30–60 grams.
Chloral hydrate	As a sedative, 30–60 grams; as a narcotic, 75–125 grams. Given in about 500 cubic centimeters water.
Chloroform	As a carminative, 4–8 cubic centimeters; as an anaesthetic, by inhalation.
Creosote	4–15 cubic centimeters.

Ether	As a carminative, 30–60 cubic centimeters; in the form of spirit, 90–180 cubic centimeters; as an anaesthetic, by inhalation.
Ferrous sulfate	5–12 grams; as the exsiccated salt, 4–8 grams.
Gentian	15–30 grams; as the fluidextract, 15–30 cubic centimeters.
Ginger	8–30 grams.
Glycerin	Diluted with 2–3 parts of water.
Linseed oil	300–500 cubic centimeters.
Mercuric chloride	0.1–0.2 gram.
Mercurous chloride (calomel)	4–8 grams.
Nux vomica	As the fluidextract, 2–8 grams; as the extract, 0.5–1 gram.
Oil, tar, rectified	8–15 cubic centimeters.
Oil, turpentine, rectified	As a carminative, 30–60 cubic centimeters, diluted with a fixed oil; as an anthelmintic, 60–120 cubic centimeters.
Phenothiazine	As an anthelmintic, 30–50 grams.
Potassium iodide	5–10 grams.
Potassium nitrate	8–15 grams.
Quinine sulfate	8–30 grams.
Sodium bicarbonate	15–60 grams.
Sodium chloride	As 0.9% solution intravenously, 1–4 litres.
Sodium sulfate	250–1000 grams in water.
Spirit of ethyl nitrite (sweet spirit of nitre)	30–90 cubic centimeters in water.
Strychnine sulfate	16–60 milligrams.
Sulfanilamide	Initial dose 75 grams per 1,000 lbs. body-weight; then 25 grams per 1,000 lbs. body-weight every 8 hours.

APPENDIX I

MEDICAL TERMS

Section I. DEFINITIONS (with examples)

Acidifying agent. One which increases the amount of acid in the body, blood, or urine. Ammonium chloride.

Addiction. A state in which the subject finds it difficult or impossible to stop taking a drug. Opium and its derivatives, especially morphine; and cocaine, are the drugs most likely to cause addiction.

Alkalizing agent. One which increases the amount of alkali in the body, blood, or urine. Sodium bicarbonate.

Amebae. Animals of microscopic size. Certain types cause disease in man, while other types are harmless.

Amebicide. An agent capable of destroying amebae. Emetine hydrochloride.

Analeptic. A restorative agent, usually one which produces awakening of a narcotized patient. Metrazol.

Analgesic. A drug which relieves pain. Morphine sulfate, codeine sulfate, acetylsalicylic acid.

Anesthetic, general. A drug used to abolish sensation and produce complete unconsciousness. Ether, cyclopropane, pentothal.

Anesthetic, local. A drug used to abolish local sensation without producing unconsciousness. Procaine.

Anhidrotic. An agent which lessens the secretion of sweat. Atropine sulfate.

Anodyne. (*See* Analgesic.)

Antacid. A drug which counteracts or neutralizes acids or acidity. Sodium bicarbonate, magnesium trisilicate.

Anthelmintic. A drug used to destroy intestinal worms. Hexylresorcinol, tetrachloroethylene.

Antianemic. A drug which causes an increase in the red cells and hemoglobin in the blood. Ferrous sulfate.

Antiasthmatic. A drug which tends to relieve or prevent asthma. Ephedrine sulfate, epinephrine hydrochloride.

Antibacterial. A drug which detroys bacteria or inhibits their multiplication. Sulfonamides.

Antibiotic. A substance obtained from living organisms that kills or inhibits growth of bacteria. Penecillin.

Anticoagulant. An agent which prevents the coagulation of the blood. Sodium citrate.

Antiketogenic. The property of preventing the excess accumulation of ketones in blood and urine.

Antiluetic. (*See* Antisyphilitic.)

Antimalarial. A drug used to combat malaria. Quinacrine hydrochloride, quinine sulfate.

Antipellagric. A substance having a beneficial effect in the deficiency disease known as pellagra.

Antipruritic. A drug which relieves itching. Phenol (in dilute solution).

Antipyretic. A drug which reduces fever without specifically curing the disease causing the fever. Acetylsalicylic acid.

Antirheumatic. A drug used in treating rheumatism. Sodium salicylate.

Antiscorbutic. An agent used for the prevention and treatment of scurvy. Ascorbic acid.

Antiseptic. A drug which stops or limits bacterial growth. Tr. iodine.

Antisyphilitic. A drug used in the treatment of syphilis. Mapharsen.

Aperient. A mild laxative. Sodium phosphate.

Ascaricide. A drug which destroys the parasitic worm, ascaris, in the gastrointestinal tract. Santonin.

Astringent. A drug which, by its local action, precipitates tissue proteins and so forms a protective covering.

Bacteria. Organisms of microscopic size; some types are capable of causing disease in man, other types are entirely harmless.

Blood pressure. The pressure of the blood as measured in the arteries.

Cardiac. Related to the heart.

Cardiac stimulant. A drug which stimulates the heart. Digitalis.

Caustic. An agent capable of destroying or corroding the soft tissues of the body. Chromic acid, silver nitrate, phenol.

Central nervous system. The brain and spinal cord.

Cerebral stimulant. A drug with stimulant action predominantly on the higher centers of the brain. Amphetamine.

Contrast media. Material, opaque to X-rays, used in outlining the shape of hollow organs in X-ray photography.

Counterirritant. An agent which produces superficial irritation and is used to relieve the discomfort of an adjacent or deep-seated abnormal process. Black mustard.

Cyanosis. A condition in which the parts normally colored red by the blood, e.g. the lips, nail-beds, and mucous membranes, take on a bluish tint.

Cycloplegic. A drug which paralyzes the focusing muscle of the eye. Atropine, homatropine.

Deliquescence. The property of attracting fluid from the atmosphere. Calcium chloride is a deliquescent substance.

Demulcent. An agent used to soothe and protect inflamed or abraded tissues, particularly the mucous membranes. Glycerin, tragacanth.

Detergent. A cleansing agent. Liquid soap, soft soap.

Disinfectant. A agent which destroys microorganisms. Formaldehyde solution.

Distention. The inflation of a hollow organ or body cavity by gas, fluid, or solid; for example, the intestines containing abnormal amounts of gas distend the abdomen.

Diuretic. A drug which increases the formation of urine. Mercurophylline, mersalyl, theophylline.

Ecbolic. (*See* Uterine stimulant.)

Edema. An unusual accumulation of lymph in any tissue, leading to a swelling of the part.

Emetic. A drug which produces vomiting. Apomorphine hydrochloride.

Emmenagogue. A drug used to produce or increase the menstrual flow. Stilbestrol.

Emollient. A drug used externally to soften or soothe the skin. Liquid petrolatum, olive oil.

Escharotic. (*See* Caustic.)

Estrogen. Estrogenic substance, a substance which stimulates the sexual functions of the female and causes menstruation.

Expectorant. A drug which promotes the secretion of mucus from the respiratory tract.

Febrifuge. (*See* Antipyretic.)

Galactagogue. An agent which increases the secretion of milk. Anterior pituitary hormone (prolactin).

Germicide. (*See* Disinfectant.)

Hematinic. (*See* Antianemic.)

Hemoglobin. The substance which gives the blood its red color. The oxygen in the blood is carried by it.

Hemostatic. An agent used to check external hemorrhage by local application. Epinephrine hydrochloride, chromic acid.

Hermetic. Impervious to air.

Hormone. A chemical substance produced in some organ, which when transported by the blood stream to other tissues, evokes specific physiological activity.

Hypnotic. A drug used to produce sleep. Chloral hydrate, barbiturates (barbital, pentobarbital, phenobarbital).

Immunize. To render an animal or man resistant to a disease by injecting small but slowly increasing amounts of the causative agent, or some substance related to it.

Irritant. A drug inducing irritation. Mustard.

Keratolytic. An agent which removes or softens hardened skin such as corns and calluses. Salicylic acid.

Ketones. Substances of definite chemical composition which are products of the body's metabolism and may reach abnormal levels in such diseases as diabetes mellitus.

Laxative. A mild cathartic. Liquid petrolatum.

Metabolism. The chemical processes by which living things convert foodstuffs into their body tissues and utilize foods for the production of energy.

Microscopic. Too small to be seen by the unaided eye but visible when magnified under the microscope.

Miotic. A drug which causes contraction of the pupil of the eye. Physostigmine salicylate.

Mydriatic. A drug which causes dilation of the pupil of the eye. Atropine sulfate, homatropine hydrobromide.

Narcotic. A drug which produces stupor or complete unconsciousness. Opium, anesthetics (general).

Nutrient. A substance providing food or nourishment.

Osmotherapeutic. A curative agent acting by means of osmosis; for example, the property of attracting fluid through living membranes.

Oxytocic. (*See* Uterine stimulant.)

Parasite. An animal or plant living from the food or substance of another animal without contributing to its welfare.

Parasiticide. A drug used to destroy parasites, usually those on the surface of the body. Sulfur, ammoniated mercury ointment.

Parasympathetic nervous system. A portion of the nervous system, stimulation of which leads to miosis, bronchoconstriction, cardiac slowing, increased secretions, and increased activity of the gastrointestinal tract.

Postpartum. Following childbirth.

Pyrogen. A substance, often of unknown chemical composition, which, after subcutaneous or intravenous injection in man, causes a fever of brief duration.

Respiratory stimulant. An agent which increases the rate and depth of respiration. Carbon dioxide.

Sedative. A drug which quiets restlessness or excitement. Sodium bromide.

Specific. A drug which has special curative effects against a certain disease. Quinine in malaria.

Stimulate. To increase the activity of any organ.

Styptic. (*See* Hemostatic.)

Sulfonamides. A class of drugs of related chemical composition; it includes sulfanilamide, sulfadiazine, sulfathiazole, sulfapyridine, sulfamerazine, and succinylsulfathiazole.

Sympathetic nervous system. A portion of the nervous system, stimulation of which leads to mydriasis, dilation of the bronchioles, speeding of the heart, vasoconstriction, rise in blood pressure, sweating and decrease in activity of the gastrointestinal tract.

Sympathomimetic. A drug which produces action similar to that which follows stimulation of the sympathetic nervous system. Epinephrine.

Synthetic. Manufactured from simpler materials by a chemical process.

Tapeworm. A worm, flattened like a tape, often found as a parasite in the muscles and the intestines of animals, and occasionally in the intestines of man.

Teniacide (*teniafuge*). A drug used to destroy tapeworms. Aspidium.

Uterine stimulant. A drug which increases the contractions of the uterus. Ergonovine maleate.

Vasoconstrictor. A drug which narrows the smaller blood vessels and thereby tends to raise arterial blood pressure. Epinephrine hydrochloride, ephedrine sulfate.

Vasodilator. A drug which widens the smaller blood vessels and thereby tends to lower arterial blood pressure. Glyceryl trinitrate.

Vesicant. A substance which, when applied to the skin in sufficient amount for a sufficient time, will cause blisters.

Viscid. Sticky, the property characteristic of paste or glue.

Vitamins. Substances other than essential foodstuffs, some of known, others of unknown chemical composition, whose absence from the diet leads to disease.

Section II. LATIN WORDS AND ABBREVIATIONS

Abbreviations or short forms	*Expanded forms*	*Meaning*
a.	auris	ear
aa.	ana	of each
a.c.	ante cibos	before meals
ad	ad	to, up to
add.	adde	add
ad lib.	ad libitum	at pleasure
agit.	agita	shake
alb.	albus	white
aq.	aqua	water
b.	bis	twice
bene	bene	well
b.i.d.	bis in die	twice a day
c̄	cum	with
cap.	capiat	let the patient take
caps.	capsula	a capsule
caps. amyl.	capsulae amylaceae	cachets
chart.	charta	paper, a powder in paper
chart. cerat.	charta cerata	waxed paper
chartul.	chartula	a small paper
coch. amp.	cochleare amplum	a tablespoonful
coch. mag.	cochleare magnum	a tablespoonful

Abbreviations or short forms	*Expanded forms*	*Meaning*
coch. med.	cochleare medium	a dessertspoonful
coch. mod.	cochleare modicum	a dessertspoonful
coch. parv.	cochleare parvum	a teaspoonful
collyr.	collyrium	an eye wash
d.	dies	a day
d.	dosis	a dose
da	da	give
d.t.d.	dentur tales doses	give such doses
dieb. alt.	diebus alternis	every other day
disp.	dispensa, dispensetur	dispense
div.	divide	divide
dos.	dosis	a dose
ejusd.	ejusdem	of the same
et	et	and
ex aq.	ex aqua	with water
e.m.p.	ex modo praescripto	after the manner prescribed, as directed
flav.	flavus	yellow
ft.	fiat, fiant	make
gtt.	gutta, guttae	a drop, drops
hor.	hora	an hour
h.s.	hora somni	at bedtime
m.	misce	mix
mitt.	mitte	send
no.	numero	in number
non	non	not
non rep.	non repetatur	do not repeat
O.	Octarius	a pint
ocul.	oculus	the eye
o.d.	oculo dextro	in right eye
o.l.	oculo laevo	in left eye
o.s.	oculo sinistro	in left eye
o.u.	oculo utroque	in each eye
p.c.	post cibos	after meals
p.ae.	partes aequales	equal parts
per	per	by means of
p.o.	per os	by mouth
placebo	placebo	to please or satisfy
p.r.n.	pro re nata	as occasion arises, as needed
pro tus.	pro tussi	for the cough
q.i.d.	quater in die	four times a day
qq. hr.	quaque hora	every hour
q.q.h.	quaque quarta hora	every four hours
q.r.	quantitas recta	the quantity is correct
q.s.	quantum sufficit	a sufficient quantity
℞	recipe	take
sig.	signa, signetur	label, let it be labeled
s̄	sine	without
s.a.	secundem artem	according to the art
s.c., sub cut.	sub cutem	subcutaneous
s.o.s.	si opus sit	if needed
ss.	semis	half

Abbreviations or short forms	*Expanded forms*	*Meaning*
stat.	statim	immediately
s.v.r.	spiritus vini rectificatus	alcohol
tal.	tales	such
t.i.d.	ter in die	three times a day
ut dict.	ut dictum	as directed
v.	vel	or
virid.	viridis	green

APPENDIX II

REFERENCE TABLES

Section I. MATHEMATICAL DATA

Equivalents of Weights and Measures

Metric, Avoirdupois and Apothecaries

Note: The values, given for the relation of weight to measure and *vice versa*, are for water at the temperature of 4° C. (39.2° F.) *in vacuo*. For ordinary, practical purposes these values may be used without correction.

Weights						Metric Weight and Measure	Measures		
Grains	Apothecaries		Avoirdupois				Fluid		Fluid-ounces and fractions
	Ozs.	Grains	Lbs.	Ozs.	Grains	Gm. or cc.*	Ounces	Minims	
15432.4	32	72.4	2	3	119.9	1000	33	391.1	33.815
15360.0	32	....	2	3	47.5	995.311	33	314.9	33.656
15060.5	31	180.5	2	2	185.5	975.906	33	....	33
15046.5	31	166.5	2	2	171.5	975	32	465.3	32.969
14880.0	31	....	2	2	5.0	964.208	32	290.1	32.604
14660.7	30	260.7	2	1	223.2	950	32	59.5	32.124
14604.1	30	204.1	2	1	166.6	946.333	32	....	32
14400.0	30	....	2	..	400.0	933.104	31	265.2	31.553
14274.9	29	354.9	2	..	274.9	925	31	133.7	31.279
14147.8	29	227.8	2	..	147.8	916.760	31	....	31
14000.0	29	80.0	2	..	....	907.185	30	324.6	30.676
13920.0	29	....	1	15	357.5	902.001	30	240.4	30.501
13889.1	28	449.1	1	15	326.6	900	30	207.9	30.433
13691.4	28	251.4	1	15	128.9	887.187	30	....	30
13562.5	28	122.5	1	15	....	878.835	29	344.4	29.718
13503.3	28	63.3	1	14	378.3	875	29	282.2	29.588
13440.0	28	....	1	14	315.0	870.897	29	215.6	29.449
13235.0	27	275.0	1	14	110.0	857.614	29	....	29
13125.0	27	165.0	1	14	....	850.486	28	364.3	28.759
13117.5	27	157.5	1	13	430.0	850	28	356.4	28.742
12960.0	27	....	1	13	272.5	839.794	28	190.8	28.397
12778.6	26	298.6	1	13	91.1	828.041	28	....	28
12731.7	26	251.7	1	13	44.2	825	27	430.6	27.897
12687.5	26	207.5	1	13	....	822.136	27	384.1	27.800
12480.0	26	....	1	12	230.0	808.690	27	165.9	27.346
12345.9	25	345.9	1	12	95.9	800	27	24.9	27.052
12322.3	25	322.3	1	12	72.3	798.469	27	....	27
12250.0	25	250.0	1	12	....	793.787	26	404.0	26.842
12000.0	25	....	1	11	187.5	777.587	26	141.1	26.294
11960.1	24	440.1	1	11	147.6	775	26	99.1	26.206
11865.9	24	345.9	1	11	53.4	768.896	26	....	26
11812.5	24	292.5	1	11	....	765.437	25	423.8	25.883
11574.3	24	54.3	1	10	199.3	750	25	173.3	25.361
11520.0	24	....	1	10	145.0	746.484	25	116.2	25.242
11409.5	23	369.5	1	10	34.5	739.323	25	....	25
11375.0	23	335.0	1	10	....	737.088	24	443.7	24.924
11188.5	23	148.5	1	9	251.0	725	24	247.5	24.516
11040.0	23	....	1	9	102.5	715.380	24	91.4	24.190
10953.1	22	393.1	1	9	15.6	709.750	24	....	24
10937.5	22	377.5	1	9	....	708.738	23	463.6	23.966

* By the "cc." in this table is meant the one-thousandth part of the liter or a milliliter (ml.).

Equivalents of Weights and Measures—*Continued*

Weights						Metric Weight and Measure	Measures		
Grains	Apothecaries		Avoirdupois				Fluid		Fluid-ounces and fractions
	Ozs.	Grains	Lbs.	Ozs.	Grains	Gm. or cc.*	Ounces	Minims	
10802.6	22	242.6	1	8	302.6	700	23	321.7	23.670
10560.0	22	....	1	8	60.0	684.277	23	66.5	23.139
10500.0	21	420.0	1	8	....	680.389	23	3.4	23.007
10496.7	21	416.7	1	7	434.2	680.177	23	....	23
10416.8	21	336.8	1	7	354.3	675	22	396.0	22.825
10080.0	21	....	1	7	17.5	653.173	22	41.7	22.087
10062.5	20	462.5	1	7	....	652.039	22	23.3	22.049
10040.4	20	440.4	1	6	415.4	650.604	22	....	22
10031.0	20	431.0	1	6	406.0	650	21	470.2	21.980
9645.2	20	45.2	1	6	20.2	625	21	64.4	21.134
9625.0	20	25.0	1	6	....	623.690	21	43.2	21.090
9600.0	20	....	1	5	412.5	622.070	21	16.8	21.035
9584.0	19	464.0	1	5	396.5	621.031	21	....	21
9259.4	19	139.4	1	5	71.9	600	20	138.6	20.289
9187.5	19	67.5	1	5	....	595.340	20	63.0	20.131
9127.6	19	7.6	1	4	377.6	591.458	20	....	20
9120.0	19	....	1	4	370.0	590.966	19	472.0	19.983
8873.6	18	233.6	1	4	123.6	575	19	212.9	19.444
8750.0	18	110.0	1	4	....	566.991	19	82.8	19.173
8671.2	18	31.2	1	3	358.7	561.885	19	....	19
8640.0	18	....	1	3	327.5	559.863	18	447.2	18.932
8487.8	17	327.8	1	3	175.3	550	18	287.1	18.598
8312.5	17	152.5	1	3	....	538.641	18	102.7	18.214
8214.8	17	54.8	1	2	339.8	532.312	18	....	18
8160.0	17	....	1	2	285.0	528.759	17	422.3	17.880
8102.0	16	422.0	1	2	227.0	525	17	361.3	17.753
7875.0	16	195.0	1	2	....	510.291	17	122.5	17.255
7758.5	16	78.5	1	1	321.0	502.739	17	....	17
7716.2	16	36.2	1	1	278.7	500	16	435.6	16.907
7680.0	16	....	1	1	242.5	497.656	16	397.5	16.828
7437.5	15	237.5	1	1	....	481.942	16	142.4	16.297
7330.4	15	130.4	1	..	330.4	475	16	29.8	16.062
7302.1	15	102.1	1	..	302.1	473.167	16	....	16
7200.0	15	....	1	..	200.0	466.552	15	372.6	15.776
7000.0	14	280.0	1	..	....	453.592	15	162.3	15.338
6944.6	14	224.6	..	15	382.1	450	15	104.0	15.217
6845.7	14	125.7	..	15	283.2	443.594	15	....	15
6720.0	14	....	..	15	157.5	435.449	14	347.8	14.725
6562.5	13	322.5	..	15	....	425.243	14	182.2	14.379
6558.8	13	318.8	..	14	433.8	425	14	178.2	14.371
6389.3	13	149.3	..	14	264.3	414.021	14	....	14
6240.0	13	....	..	14	115.0	404.345	13	322.9	13.673
6172.9	12	412.9	..	14	47.9	400	13	252.4	13.526
6125.0	12	365.0	..	14	....	396.893	13	202.0	13.421
5932.9	12	172.9	..	13	245.4	384.448	13	....	13
5787.1	12	27.1	..	13	99.6	375	12	326.6	12.681
5760.0	12	....	..	13	72.5	373.242	12	298.1	12.621
5687.5	11	407.5	..	13	....	368.544	12	221.9	12.462
5476.6	11	196.6	..	12	226.6	354.875	12	....	12
5401.3	11	121.3	..	12	151.3	350	11	400.8	11.835
5280.0	11	....	..	12	30.0	342.138	11	273.3	11.569
5250.0	10	450.0	..	12	....	340.194	11	241.7	11.504
5020.2	10	220.2	..	11	207.7	325.302	11	....	11
5015.5	10	215.5	..	11	203.0	325	10	475.1	10.990

* By the "cc." in this table is meant the one-thousandth part of the liter or a milliliter (ml.).

Equivalents of Weights and Measures—*Continued*

Weights						Metric Weight and Measure	Measures		
Grains	Apothecaries		Avoirdupois				Fluid		Fluid-ounces and fractions
	Ozs.	Grains	Lbs.	Ozs.	Grains	Gm. or cc.*	Ounces	Minims	
4812.5	10	12.5	..	11	....	311.845	10	261.6	10.545
4800.0	10	....	..	10	425.0	311.035	10	248.4	10.518
4629.7	9	309.7	..	10	254.7	300	10	69.3	10.144
4563.8	9	243.8	..	10	188.8	295.729	10	....	10
4375.0	9	55.0	..	10	....	283.495	9	281.4	9.586
4320.0	9	....	..	9	382.5	279.931	9	223.6	9.466
4244.0	8	403.9	..	9	306.4	275	9	143.5	9.299
4107.4	8	267.4	..	9	169.9	266.156	9	....	9
3937.5	8	97.5	..	9	....	255.146	8	301.3	8.628
3858.1	8	18.1	..	8	358.1	250	8	217.8	8.454
3840.0	8	....	..	8	340.0	248.828	8	198.7	8.414
3651.0	7	291.0	..	8	151.0	236.583	8	....	8
3500.0	7	140.0	..	8	....	226.796	7	321.1	7.669
3472.3	7	112.3	..	7	409.8	225	7	292.0	7.608
3360.0	7	....	..	7	297.5	217.724	7	173.9	7.362
3194.7	6	314.7	..	7	132.2	207.010	7	....	7
3086.5	6	206.5	..	7	24.0	200	6	366.2	6.763
3062.5	6	182.5	..	7	....	198.447	6	341.0	6.710
2880.0	6	....	..	6	255.0	186.621	6	149.0	6.311
2738.3	5	338.3	..	6	113.3	177.437	6	....	6
2700.7	5	300.7	..	6	75.7	175	5	440.4	5.918
2625.0	5	225.0	..	6	....	170.097	5	360.9	5.752
2400.0	5	....	..	5	212.5	155.517	5	124.2	5.259
2314.9	4	394.9	..	5	127.4	150	5	34.7	5.072
2281.9	4	361.9	..	5	94.4	147.865	5	....	5
2187.5	4	267.5	..	5	....	141.748	4	380.7	4.793
1929.0	4	9.0	..	4	179.0	125	4	108.9	4.227
1920.0	4	....	..	4	170.0	124.414	4	99.4	4.207
1825.5	3	385.5	..	4	75.5	118.292	4	....	4
1750.0	3	310.0	..	4	....	113.398	3	400.6	3.835
1543.2	3	103.2	..	3	230.7	100	3	183.1	3.381
1440.0	3	....	..	3	127.5	93.310	3	74.5	3.155
1388.9	2	428.9	..	3	76.4	90	3	20.8	3.043
1369.1	2	409.1	..	3	56.6	88.719	3	....	3
1312.5	2	352.5	..	3	....	85.049	2	420.4	2.876
1234.6	2	274.6	..	2	359.6	80	2	338.5	2.705
1157.4	2	197.4	..	2	282.4	75	2	257.3	2.536
1080.3	2	120.3	..	2	205.3	70	2	176.2	2.367
960.0	2	....	..	2	85.0	62.207	2	49.7	2.104
925.9	1	445.9	..	2	50.9	60	2	13.9	2.029
912.8	1	432.8	..	2	37.8	59.146	2	....	2
875.0	1	395.0	..	2	....	56.699	1	440.3	1.917
771.6	1	291.6	..	1	334.1	50	1	331.5	1.691
617.3	1	137.3	..	1	179.8	40	1	169.2	1.353
480.0	1	....	..	1	42.5	31.1035	1	24.9	1.052
463.0	..	....	..	1	25.5	30	1	6.9	1.014
456.380	..	....	..	1	18.88	29.5729	1	....	1
437.5	..	....	..	1	....	28.350	..	460.15	0.959
385.8	..	....	..	..	....	25	..	405.78	0.845
308.6	..	....	..	..	....	20	..	324.62	0.676
154.3	..	....	..	..	....	10	..	162.31	0.338
15.4324	..	....	..	..	....	1	..	16.23	0.0338
1	..	....	..	..	....	0.06480	..	1.0517	0.0022
0.9508	..	....	..	..	....	0.06161	..	1	0.0021

* By the "cc." in this table is meant the one-thousandth part of the liter or a milliliter (ml.).

Equivalents of Weights and Measures—*Continued*

From 480 grains down

Grains	Metric weight and measure Gm. or cc.*	Minims (of water at 4° C.)	Grains	Metric weight and measure Gm. or cc.*	Minims (of water at 4° C.)
480 [1 ℥	31.103	504.8	240 [4 ℥	15.552	252.4
478.4	31	503.2	231.5	15	243.5
475.4	30.805	500	228.2	14.786	240.0
463.0	30	486.9	218.75 [½ av. oz.	14.175	230.1
456.4	29.573	480 [1 f℥	216.1	14	227.2
450	29.160	473.3	210	13.608	220.9
447.5	29	470.7	200.6	13	211.0
437.5 [1 av. oz.	28.350	460.2	199.7	12.938	210.0
432.1	28	454.5	185.2	12	194.8
427.9	27.725	450			
420 [7 ℥	27.216	441.7	180 [3 ℥	11.664	189.3
416.7	27	438.2	171.1	11.090	180.0
401.2	26	422.0	169.8	11	178.5
399.3	25.876	420	154.3	10	162.3
390	25.272	410.2	150	9.720	157.8
385.8	25	405.8	142.6	9.242	150.0
380.3	24.644	400	138.9	9	146.1
370.8	24.028	390	123.5	8	129.8
370.4	24	389.5			
360 [6 ℥	23.328	378.6	120 [2 ℥	7.776	126.2
354.9	23	373.3	114.1	7.393	120.0
342.3	22.180	360	109.375 [¼ av. oz.	7.087	115.0
339.5	22	357.1	108.0	7	113.6
330	21.384	347.1	100	6.480	105.2
324.1	21	340.9	95.1	6.161	100.0
313.8	20.331	330	92.6	6	97.4
308.6	20	324.6	80	5.184	84.1
			77.2	5	81.2
			76.1	4.929	80.0
			61.7	4	64.9
300 [5 ℥	19.440	315.5	60 [1 ℥	3.888	63.1
293.2	19	308.4	57.0	3.697	60.0
285.2	18.483	300	54.6875 [⅛ av. oz.	3.544	57.5
277.8	18	292.2	47.5	3.081	50.0
270	17.496	284.0	50	3.240	52.6
262.4	17	275.9	46.3	3	48.7
256.7	16.635	270	42.8	2.772	45.0
246.9	16	259.7	40	2.592	42.1
			38.0	2.464	40.0
			33.3	2.156	35.0
			30.9	2	32.5

* By the "cc." in this table is meant the one-thousandth part of the liter or a milliliter (ml.).

Equivalents of Weights and Measures—*Continued*

From 30 grains down			Weights from 5 grains down	
Grains	Metric weight and measure Gm. or cc.*	Minims (of water at 4° C.)	Milligrams (mg.)	Grains
30 [½ ʒ	1.944	31.55	324 mg.	5
28.52	1.848	30	292 mg.	4½
23.77	1.540	25	259 mg.	4
20	1.296	21.04	227 mg.	3½
19.02	1.232	20	194 mg.	3
15.4324	1	16.23	162 mg.	2½
			130 mg.	2
15	0.972	15.78	97 mg.	1½
14.26	0.924	15	65 mg.	1
14	0.907	14.72		
13.31	0.863	14	60.7 mg.	15/16
13	0.842	13.67	58.3 mg.	9/10
12.36	0.801	13	56.7 mg.	7/8
12	0.778	12.63	52.6 mg.	13/16
11.41	0.739	12	51.8 mg.	5/6
11	0.713	11.57	48.6 mg.	3/4
10.46	0.678	11	44.5 mg.	11/16
			40.5 mg.	5/8
10	0.648	10.52	36.4 mg.	9/16
9.51	0.616	10	32.4 mg.	½
9	0.583	9.46		
8.56	0.554	9	28.3 mg.	7/16
8	0.518	8.41	25.9 mg.	3/8
7.72	0.5	8.12	24.3 mg.	3/8
7.61	0.493	8	20.2 mg.	5/16
7	0.454	7.37	16.2 mg.	¼
6.66	0.431	7	12.1 mg.	3/16
6	0.389	6.31	8.1 mg.	⅛
5.70	0.370	6	4.0 mg.	1/16
			3.2 mg.	1/20
5	0.324	5.26	2.6 mg.	1/25
4.75	0.308	5	2.2 mg.	1/30
4	0.259	4.20	1.8 mg.	1/36
3.80	0.246	4	1.6 mg.	1/40
3	0.194	3.15	1.3 mg.	1/50
2.85	0.185	3	1.1 mg.	1/60
2	0.130	2.11	1.0 mg.	1/64
1.90	0.123	2	0.6 mg.	1/100
1	0.06480	1.0518	0.5 mg.	1/128
0.9508	0.06161	1	0.4 mg.	1/160
			0.3 mg.	1/210
			0.2 mg.	1/320
			0.1 mg.	1/640

* By the "cc." in this table is meant the one-thousandth part of the liter or a milliliter (ml.).

Equivalents of Linear Measures

Metric to English

Centimeters	Inches	Centimeters	Inches	Millimeters	Inches—	
					In decimal fractions	In 32ds.
150	59.06	55	21.65	25.4	1	$^{32}/_{32}$
145	57.09	53.3	21	25	0.98	....
140	55.12	50.8	20	24.0	0.94	....
139.7	55	50	19.69	23.8	0.94	$^{30}/_{32}$
135	53.15	48.3	19	23.0	0.91	$^{29}/_{32}$
130	51.18	45.7	18	22.2	0.88	$^{28}/_{32}$
127.0	50	45	17.72	22.0	0.87	....
125	49.21	43.2	17	21.0	0.83	....
120	47.24	40.6	16	20.6	0.81	$^{26}/_{32}$
115	45.28	40	15.75	20	0.79	....
114.3	45	38.1	15	19.1	0.75	$^{24}/_{32}$
110	43.31	35.6	14	19.0	0.75	....
105	41.34	35	13.78	18.0	0.71	....
101.6	40	33.0	13	17.5	0.69	$^{23}/_{32}$
100	39.37	30.5	12	17.0	0.67	....
99.1	39	30	11.81	16.0	0.63	....
96.5	38	27.9	11	15.9	0.62	$^{20}/_{32}$
95	37.40	25.4	10	15	0.59	....
94.0	37	25	9.84	14.3	0.56	$^{18}/_{32}$
91.4	36	22.9	9	14.0	0.55	....
90	35.43	20.3	8	13.0	0.51	....
88.9	35	20	7.87	12.7	0.50	$^{16}/_{32}$
86.4	34	17.8	7	12.0	0.47	....
85	33.46	15.2	6	11.1	0.44	$^{14}/_{32}$
83.8	33	15	5.91	11.0	0.43	....
81.3	32	12.7	5	10	0.39	....
80	31.50	10.2	4	9.5	0.38	$^{12}/_{32}$
78.7	31	10	3.94	9	0.35	....
76.2	30	9	3.54	8.7	0.34	$^{11}/_{32}$
75	29.53	8	3.15	8	0.31	....
73.7	29	7.6	3	7.9	0.31	$^{10}/_{32}$
71.1	28	7	2.76	7.1	0.28	$^{9}/_{32}$
70	27.56	6	2.36	7	0.28	....
68.6	27	5.1	2	6.4	0.25	$^{8}/_{32}$
66.0	26	5	1.97	6	0.24	....
65	25.59	4	1.57	5.6	0.22	$^{7}/_{32}$
63.5	25	3	1.18	5	0.20	....
61.0	24	2.54	1	4.8	0.19	$^{6}/_{32}$
60	23.62	2	0.79	4	0.16	....
58.4	23	1	0.39	3.2	0.12	$^{5}/_{32}$
55.9	22			3	0.12	....
				2.4	0.09	$^{3}/_{32}$
				2	0.08	....
				1.6	0.06	$^{2}/_{32}$
				1	0.04	....
				0.8	0.03	$^{1}/_{32}$
				0.1	0.0039	....

Equivalents of Linear Measures

English to Metric

Feet	Meters	Centimeters	Inches	Milli-meters	Inches in fractions	Inches in decimal fractions	Millimeters
25	7.620	762.0	34	863.6	1 15/16	1.000	25.40
24	7.315	731.5	33	838.2	1 15/16	0.9375	23.81
23	7.010	701.0	32	812.8	7/8	0.8750	22.22
22	6.706	670.6	31	787.4	1 13/16	0.8125	20.64
21	6.401	640.1	30	762.0	5/8	0.7500	19.05
20	6.096	609.6	29	736.6	1 1/16	0.6875	17.46
19	5.791	579.1	28	711.2	5/8	0.6250	15.88
18	5.486	548.6	27	685.8	9/16	0.5625	14.29
17	5.182	518.2	26	660.4	1/2	0.5000	12.70
16	4.877	487.7	25	635.0	7/16	0.4375	11.11
15	4.572	457.2	24	609.6	3/8	0.3750	9.52
14	4.267	426.7	23	584.2	5/16	0.3125	7.94
13	3.962	396.2	22	558.8	1/4	0.2500	6.35
12	3.658	365.8	21	533.4	3/16	0.1875	4.76
11	3.353	335.3	20	508.0	1/8	0.1250	3.18
10	3.048	304.8	19	482.6	1/16	0.0625	1.59
9	2.743	274.3	18	457.2	1/32	0.03125	0.79
8	2.438	243.8	17	431.8	1/64	0.01562	0.40
7	2.134	213.4	16	406.4	1/100	0.01000	0.25
6	1.829	182.9	15	381.0	1/200	0.00500	0.127
5	1.524	152.4	14	355.6	1/320	0.00312	0.08
4	1.219	121.9	13	330.2	2/3	0.667	16.93
3	0.9144	91.44	12	304.8	1/3	0.333	8.47
2	0.6096	60.96	11	279.4	4/5	0.800	20.32
1	0.3048	30.48	10	254.0	3/5	0.600	15.24
0.9	0.2743	27.43	9	228.6	2/5	0.400	10.16
0.8	0.2438	24.38	8	203.2	1/10	0.100	2.54
0.7	0.2134	21.34	7	177.8			
0.6	0.1829	18.29	6	152.4			
0.5	0.1524	15.24	5	127.0			
0.4	0.1219	12.19	4	101.6			
0.3	0.0914	9.144	3	76.2			
0.2	0.0610	6.096	2	50.8			
0.1	0.0305	3.048	1	25.4			

Table for Converting Metric Quantities in Pharmaceutical Processes to Quantities in Avoirdupois Weight

Grams to grains, etc. (Product measured)

Grams per liter	Grains per fluidounce		Grains, etc., per pint		Grains, etc., per gallon		
	Ounces avoir.	Grains	Ounces avoir.	Grains	Pounds avoir.	Ounces avoir.	Grains
1	..	0.46	..	7.3	..	..	58.4
2	..	0.91	..	14.6	..	..	116.8
3	..	1.37	..	21.9	..	..	175.3
4	..	1.83	..	29.2	..	..	233.7
5	..	2.28	..	36.5	..	..	292.1
6	..	2.74	..	43.8	..	..	350.5
7	..	3.19	..	51.1	..	..	408.9
8	..	3.65	..	58.4	..	1	30.0
9	..	4.10	..	65.7	..	1	88.0
10	..	4.56	..	73.0	..	1	147.0
20	..	9.13	..	146.0	..	2	293.0
30	..	13.69	..	219.1	..	4	3.0
40	..	18.26	..	292.1	..	5	149.0
50	..	22.82	..	365.1	..	6	296.0
60	..	27.38	1	0.6	..	8	5.0
70	..	31.95	1	73.7	..	9	152.0
80	..	36.51	1	146.7	..	10	299.0
90	..	41.08	1	219.7	..	12	8.0
100	..	45.64	1	292.7	..	13	154.0
200	..	91.28	3	148.0	1	10	309.0
300	..	136.92	5	3.0	2	8	26.0
400	..	182.56	6	296.0	3	5	180.0
500	..	228.20	8	151.0	4	2	334.0
600	..	273.84	10	6.0	5	0	51.0
700	..	319.47	11	299.0	5	13	204.0
800	..	365.11	13	154.0	6	10	360.0
900	..	410.75	15	10.0	7	8	76.0
1000	1	18.89	16	302.0	8	5	231.0

Example: To make 1 gallon.

Camphor and Soap Liniment

Hard Soap	60 Gm.	(Table I)	8 oz. 5 grs.
Camphor	45 Gm.	(Table I)	40 Gm. 5 oz. 149 grs. 5 Gm. 292.1 grs.
Oil of Rosemary	10 cc.	(Table II)	1 fl. oz. 134 min.
Alcohol	700 cc.	(Table II)	5 pts. 9 fl. oz. 288 min.
Water, sufficient to make	1000 cc.		or 1 gallon

Table for Converting Metric Quantities in Pharmaceutical Processes to Quantities in Apothecaries Measure

Cc. to minims, etc. (Product measured)

Cc. per liter	Minims per fluidounce	Minims, etc., per pint		Minims, etc., per gallon		
		Fl. oz.	Minims	Pints	Fl. oz.	Minims
1	0.48	..	7.68	..	..	61
2	0.96	..	15.36	..	..	123
3	1.44	..	23.04	..	..	184
4	1.92	..	30.72	..	..	246
5	2.40	..	38.40	..	..	307
6	2.88	..	46.09	..	..	369
7	3.36	..	53.76	..	..	430
8	3.84	..	61.44	..	1	12
9	4.32	..	69.12	..	1	73
10	4.80	..	76.80	..	1	134
20	9.60	..	153.60	..	2	269
30	14.40	..	230.40	..	3	403
40	19.20	..	307.20	..	5	58
50	24.00	..	384.00	..	6	192
60	28.80	..	460.80	..	7	326
70	33.60	1	57.60	..	8	461
80	38.40	1	134.40	..	10	115
90	43.20	1	211.20	..	11	250
100	48.00	1	288.00	..	12	384
200	96.00	3	96.00	1	9	288
300	144.00	4	384.00	2	6	192
400	192.00	6	192.00	3	3	96
500	240.00	8	.....	4	..	...
600	288.00	9	288.00	4	12	384
700	336.00	11	96.00	5	9	288
800	384.00	12	384.00	6	6	192
900	432.00	14	192.00	7	3	96
1000	480.00	16	.....	8	..	...

Table for Converting Metric Quantities in Pharmaceutical Processes to Quantities in Apothecaries Weight

Parts per 1000 to grains, etc., per pound avoirdupois

Grams per kilogram	Grains and apothecaries ounces per pound avoirdupois		Grains and ounces avoirdupois per pound avoirdupois	
	Ounces	Grains	Ounces	Grains
1	..	7	..	7.0
2	..	14	..	14.0
3	..	21	..	21.0
4	..	28	..	28.0
5	..	35	..	35.0
6	..	42	..	42.0
7	..	49	..	49.0
8	..	56	..	56.0
9	..	63	..	63.0
10	..	70	..	70.0
20	..	140	..	140.0
30	..	210	..	210.0
40	..	280	..	280.0
50	..	350	..	350.0
60	..	420	..	420.0
70	1	10	1	52.5
80	1	80	1	122.5
90	1	150	1	192.5
100	1	220	1	262.5
200	2	440	3	87.5
300	4	180	4	350.0
400	5	400	6	175.0
500	7	140	8	....
600	8	360	9	262.5
700	10	100	11	87.5
800	11	320	12	350.0
900	13	60	14	175.0
1000	14	280	16	....

Example: To make 1 pound avoirdupois.

Camphor Liniment

Camphor	200 Gm.	(Table III)	3 oz. 87.5 grs.
Cottonseed Oil	800 Gm.	(Table III)	12 oz. 350.0 grs.
To make	1000 Gm.		or 1 pound avoirdupois

Percentage Solutions

Percentage concentrations of solutions are expressed as follows:

Percent "weight in weight" (w/w) expresses the number of grams of an active constituent in 100 grams of solution.

Percent "weight in volume" (w/v) expresses the number of grams of an active constituent in 100 cubic centimeters of solution.

Percent "volume in volume" (v/v) expresses the number of cubic centimeters of an active constituent in 100 cubic centimeters of solution.

When "percent" is used in prescriptions without qualification, it means: for solutions of solids in liquids, percent weight in volume; for solutions of liquids in liquids, percent volume in volume; and for solutions of gases in liquids, percent weight in volume. For example, a 1 percent solution is prepared by dissolving 1 gram of a solid or 1 cubic centimeter of a liquid

in sufficient of the solvent to make 100 cubic centimeters of the solution. A solution of the same strength may be prepared by apothecaries weight and measure by dissolving 4.5 grains (more accurately 4.5457 grains) of a solid or 4.8 minims of a liquid in sufficient of the solvent to make 1 fluidounce of the solution at 25° C.

In dispensing prescriptions, slight changes in volume owing to variations in room temperature may be disregarded.

Hydrogen Ions and pH

Many of the compounds which are pharmacologically important are acids, bases, or salts. In aqueous or hydroalcoholic solution they tend, in great or small degree, to dissociate into their respective ions. The concentration and activity of hydrogen ions in a solution influences the concentrations of the anions, cations, and undissociated molecules present in the solution. These factors, in many instances, affect the stability, therapeutic activity, and pharmaceutical elegance of medicaments in aqueous or hydroalcoholic solutions.

Some Principles of Acid-Base Equilibrium and pH. The dissociation of acids may be represented by the type description:

$$AH \rightleftarrows H^+ + A^-$$

In a similar manner the dissociation of substituted ammoniums may be represented by

$$BH^+ \rightleftarrows B + H^+$$

The dissociation of the metallic hydroxides may be represented by

$$BOH \rightleftarrows B^+ + OH^-$$

For the purpose of this discussion, salts, certain acids, and the hydroxides of the alkali metals are assumed to be completely dissociated in dilute aqueous solution.

At equilibrium the ordinary mass action equation will hold as a first approximation for weak acids:

$$\frac{[H^+]\,[A^-]}{[HA]} = K_a \quad (1) \qquad \frac{[A^-]}{[HA]} = \frac{K_a}{[H^+]}, \quad (2)$$

where the brackets indicate molar concentration of each ionic or molecular species.

The constant, K_a, is the classical dissociation constant of the acid. The value of K_a is markedly different for various acids, and for the same acid it is appreciably affected by the presence and concentrations of various ions in solution. The ratio $\frac{[A^-]}{[HA]}$ in equation (2) is seen to depend upon the value of K_a and the concentration of hydrogen ions. Assuming that K_a remains constant, the ratio $\frac{[A^-]}{[HA]}$ can be changed only by changing the value of $[H^+]$. This can be accomplished by the addition of a strongly dissociated acid which increases $[H^+]$ or the addition of a strongly dissociated base which will decrease the value of $[H^+]$.

Furthermore, the ratio $\frac{[A^-]}{[HA]}$ may be changed by the addition of the acid itself or its salt, but not directly as the ratio of these added quantities, for $[H^+]$ will have been changed also.

The magnitudes of $[H^+]$ vary enormously, that is, from one to one ten-millionth squared or 10^{-14}. The desirability of an exponential or loga-

rithmic scale of expression is at once apparent. The system generally adopted is that devised by Sørenson, namely, the use of the symbol pH, which is defined as *the negative logarithm of the hydrogen-ion concentration.* Hence—

$$pH = -\log [H^+] \text{ or } \log \frac{1}{[H^+]} \tag{3}$$

The relation of pH to $[H^+]$ may be seen in the following table:

	pH	*Normality in terms of hydrogen ions*	*Normality in terms of hydroxyl ions*
	0	1	10^{-14}
	1	10^{-1}	10^{-13}
	2	10^{-2}	10^{-12}
	3	10^{-3}	10^{-11}
	4	10^{-4}	10^{-10}
	5	10^{-5}	10^{-9}
	6	10^{-6}	10^{-8}
Neutral point	7	10^{-7}	10^{-7}
	8	10^{-8}	10^{-6}
	9	10^{-9}	10^{-5}
	10	10^{-10}	10^{-4}
	11	10^{-11}	10^{-3}
	12	10^{-12}	10^{-2}
	13	10^{-13}	10^{-1}
	14	10^{-14}	1

The logarithmic nature of this system should be borne in mind constantly in considering changes in hydrogen-ion concentration and its connotation in terms of pH as illustrated in the following table:

$[H^+]$ *Times increased or decreased*	pH *Corresponding change*
10	1.00
5	0.70
2	0.30
1.5	0.18
1.1	0.04
1.05	0.02
1.023	0.01

Equation (2) may be written

$$\log \frac{[A^-]}{[HA]} + \log \frac{1}{K_a} = pH \tag{4}$$

Obviously when the ratio $\frac{[A^-]}{[HA]}$ is unity, $\log \frac{1}{K_a}$ will be equal to pH. Also, when pH is greater than $\log \frac{1}{K_a}$ by two units, practically the entire compound exists as species A^-. When pH, however, is less than $\log \frac{1}{K_a}$ by two units, practically the entire compound exists as species HA. When pH has a value lying within ± 2 units $\log \frac{1}{K_a}$, there will be relatively large proportions of each species present.

The standard device generally used in the determination of hydrogen-ion concentration is the hydrogen half-cell.

A hydrogen half-cell consists of a noble metal electrode, immersed in a solution containing hydrogen ions or substances capable of supplying such ions at the activity symbolized by (H^+), under a definite partial pressure of hydrogen, P_{H_2}, and supplied with a catalyst such as platinum black to facilitate the half-reaction:

$$H_2 \rightleftharpoons 2H^+ + 2e$$

When two such half-cells are placed in liquid junction, the electromotive force E of the cell is defined by—

$$E = \frac{RT}{F} \ln \frac{(H^+)' \sqrt{P_{H_2}}}{(H^+) \sqrt{P'_{H_2}}} + E_L, \qquad (5)$$

Where $(H^+)'$ is the activity of the hydrogen ions in the half-cell having the greater hydrogen-ion activity, P'_{H_2} is the hydrogen pressure in the same half-cell and E_L is the potential jump at the liquid junction of the half-cells. The latter is not eliminated but is reduced to a small, usually neglected value, by making the junction with saturated potassium chloride solution.

The ultimate standard of reference is the hydrogen half-cell in which the hydrogen-ion activity is unity and the hydrogen pressure is one atmosphere. If this half-cell were used in conjunction with another half-cell of lower hydrogen-ion activity and the hydrogen pressure were the same in the two half-cells, then—

$$E = \frac{RT}{F} \ln \frac{1}{(H^+)} \quad \text{or} \qquad (6)$$

at 20° C.,

$$E = 0.0581 \log \frac{1}{(H^+)} \qquad (7)$$

The foregoing ultimate standard of reference is not used in practice and it is impossible either to eliminate entirely the liquid junction potential or to calculate it with exactitude. Therefore for pharmacopoeial purposes the following is adopted for approximate measurements:

$$Hg \mid Hg_2Cl_2, KCl \text{ (Sat. Soln.)} \mid \begin{matrix}\text{Solution of} \\ \text{unknown pH}\end{matrix} \mid Pt, H_2 \text{ (1 atmos.)}$$

Employing this cell at 20° C., pH may be calculated by the following equation:

$$pH = \frac{E - 0.2488}{0.0581} \qquad (8)$$

The electromotive force is measured by means of a potentiometer.

When the standard 0.05 molar potassium biphthalate solution is employed in the foregoing cell, in place of the solution of unknown pH at 20° C., the cell has an electromotive force of 0.4797 volt, corresponding to pH 3.974.

These half-cells employed under the prescribed conditions constitute the reference device for pH measurements for the solutions of the Pharmacopoeia. For pharmacopoeial purposes various electrodes may be employed at the discretion of the operator which are capable of as great a degree, or a greater degree, of accuracy than that set forth in the colorimetric method, namely, ± 0.1 pH.

When the electrometric method is employed for hydroalcoholic solutions and the electromotive force developed converted into pH, the conversion is based on the assumption that the equation holds for hydroalcoholic solutions as it does for aqueous solutions. Strictly speaking this condition does not obtain. Therefore the values expressed as pH are relative and subject to change with varying concentrations of alcohol.

The term pH is expressed generally by an integer and two significant decimals. The reliability of the value of the figures in the second decimal place is dependent largely on the method employed in carrying out the determination. For pharmacopoeial purposes, the expression is given with one decimal only. For practically all purposes of this text, this degree of accuracy is considered sufficient. However, the method to be described is capable of a higher degree of accuracy.

Determination of pH. For convenience the colorimetric method of determining hydrogen-ion concentration has been adopted for pharmacopoeial purposes and is to be employed where pigments or proteins present in the solution do not vitiate its use. In these instances the potentiometric method must be employed.

The principle of the colorimetric method depends upon the assumption that an indicator in the same concentration will exhibit the same transition shade in different aqueous solutions if the hydrogen-ion concentrations of the solutions are the same. Having then a series of buffer solutions of definite hydrogen-ion concentrations, comparisons can be made between the shades of color produced in the buffer solutions and that produced by the same indicator in the solution to be tested.

As it was stated previously, the K_a of an acid is affected by the ionic strength of the solution, likewise the K_a of indicators is affected also. This influences the color transition range of the indicator. The electrometric method measures the activity of the hydrogen ions (H^+) and to obtain the same value by the colorimetric method in solutions of various ionic strengths, a correction, known as the salt-error correction, must be employed. In addition, the kinds of ions present in solution and their precipitating influence on the indicator affect the accuracy of the colorimetric method. For pharmacopoeial purposes, where the complexity of the medicaments make a simple application of these corrections impossible, the corrections are ignored.

Directions for pH measurements. In the determination of an unknown pH value, a suitable indicator must first be found. Only indicators which show an intermediate color between the extreme acid and alkaline colors can be used.

The first step in the choice of a suitable indicator is the determination of the approximate pH value of the solution under investigation. A few simple tests will usually supply the necessary information. Add a drop or two of phenolphthalein T.S. to a small portion of the solution. If the indicator remains colorless, the pH of the solution is less than 8.4. A second test is conducted in the same manner, using methyl orange T.S. as the indicator. If the solution assumes the alkaline color (yellow), the pH of the solution is greater than 4.4 and lies somewhere between 4.4 and 8.0. A few more tests with methyl red (pH interval 4.2–6.3), bromothymol blue (6.0–7.6), and phenol red (6.8–8.4) will give a close enough approximation of the pH value to show which indicator may be successfully used in the determination.

Instead of testing small amounts of the liquid with indicator solutions, the spot method, using indicator papers, may be substituted. Also, by using a universal indicator in place of the several indicator solutions suggested above, some time may be saved.

When the approximate pH value has been determined and a suitable indicator agreed upon, a 3-, 5-, or 10-cc. portion of the unknown solution (depending upon the amount of the liquid available), is transferred to a hard, resistant glass test tube approximately 15 cm. long and 1.5 cm. $\pm$ 0.5 mm. bore, and a measured amount of the indicator solution added. As a

rule, 0.10 to 0.20 cc. of a 0.05 per cent indicator solution, added from a 1-cc. pipette, graduated to 0.01 cc. per 10 cc. of the solution being tested, constitutes a proper indicator concentration.

Transfer from 4 to 6 portions of the buffer solutions, the pH values of which overlap that of the unknown solution, to test tubes and treat in exactly the same way as the solution being analyzed. The same amounts of indicator must be added to the unknown and to the buffer solutions. It is also essential that the test tubes used be of the quality and type already indicated. The color of the unknown solution is then compared with the colors of the buffer solutions and the pH value of the solution thus determined.

In judging the colors, observe them against a white background with the light transmitted through the whole length of the tube. A suitable colorimeter may also be used, although it is not necessary in routine work. A sufficient number of reference solutions must be taken so that the color of the unknown falls between two of the series, differing by not more than 0.20 pH. The pH of the unknown can thus be easily approximated to within 0.1 and with practice to 0.05. With buffer solutions differing by 0.1 pH unit or less, the experimental error can be reduced to about 0.02 pH.

Other colorimetric methods capable of the same or a greater degree of accuracy than that required by the Pharmacopoeia may be employed at the discretion of the operator.

The dissociation constants of indicators hold for aqueous solutions only. Alcohol changes this value and therefore for alcoholic solutions a correction factor must be used or the potentiometric method employed.

Indicators and Preparation of Their Solutions

The indicators used for colorimetric pH determinations are either weakly acid or weakly basic. Most of the indicators, however, used for this purpose, such as the phthaleins and sulfonated phthaleins, behave like weak acids.

The usual concentration of the indicator solution is 0.05 per cent. From 0.1 to 0.2 cc. of the indicator solution is generally used for 10 cc. of the liquid being examined.

Solutions of indicators of the basic type and of the phthaleins are prepared by dissolving them in alcohol. In preparing solutions of indicators containing an acid group, this group must first be neutralized with sodium hydroxide. The procedure is as follows:

One-tenth (0.100) Gm. of the indicator is triturated in an agate mortar with the volume of twentieth-normal sodium hydroxide specified in the following table, or with its equivalent of fiftieth-normal sodium hydroxide. When the indicator has dissolved the solution is diluted with carbon-dioxide-free distilled water to make 200 cc. (0.05 per cent).

The solutions should be kept in stoppered bottles, and protected from light.

Table of pH Indicators

Indicator	*pH range*	*Molecular weight*	*Color change*	*Solvent*
Methyl yellow	2.9– 4.0	225	Red–yellow	Alcohol
Bromophenol blue	3.0– 4.6	669	Yellow–blue	3.0 cc. N/20 NaOH
Methyl red	4.2– 6.3	269	Red–yellow	7.4 cc. N/20 NaOH
Bromocresol purple	5.2– 6.8	540	Yellow–purple	3.7 cc. N/20 NaOH
Bromothymol blue	6.0– 7.6	624	Yellow–blue	3.2 cc. N/20 NaOH
Phenol red	6.8– 8.4	354	Yellow–red	5.7 cc. N/20 NaOH
Thymol blue	8.0– 9.6	466	Yellow–blue	4.3 cc. N/20 NaOH
Thymolphthalein	9.3–10.5	430	Colorless–blue	Alcohol

Solutions Used in Preparation of Buffer Solutions

Fifth-molar hydrochloric acid and fifth-molar sodium hydroxide (carbonate free) are prepared and standardized according to directions given under standard solutions.

1. *Potassium biphthalate solution.* Dissolve 40.836 Gm. of reagent potassium biphthalate in distilled water and dilute to 1000 cc. to prepare a fifth-molar solution for use in preparing the buffer solutions.

2. *Monopotassium phosphate solution.* Dissolve 27.240 Gm. of reagent monopotassium phosphate in distilled water and dilute to 1000 cc. to make a fifth-molar solution for use in preparing the buffer solutions.

3. *Boric acid and potassium chloride solution.* Dissolve 12.404 Gm. of reagent boric acid and 14.912 Gm. of reagent potassium chloride in distilled water and dilute to 1000 cc. to prepare a fifth-molar solution of these mixed salts.

4. *Potassium chloride solution.* Dissolve 14.912 Gm. reagent potassium chloride in distilled water and dilute to 1000 cc. to make a fifth-molar solution for use in preparing the buffer solutions.

5. *Potassium biphthalate solution for hydrogen electrode.* Solution (1) diluted with three volumes of distilled water at 20° C. prepares twentieth-molar potassium biphthalate solution for checking the hydrogen electrode.

BUFFER MIXTURES OF CLARK AND LUBS

pH			
	HCl-KCl mixtures		
1.1	94.56 cc. M/5 HCl	5.44 cc. M/5 KCl	Dilute to 200 cc.
1.2	75.10 cc. M/5 HCl	24.90 cc. M/5 KCl	Dilute to 200 cc.
1.3	59.68 cc. M/5 HCl	40.32 cc. M/5 KCl	Dilute to 200 cc.
1.4	47.40 cc. M/5 HCl	52.60 cc. M/5 KCl	Dilute to 200 cc.
1.5	37.64 cc. M/5 HCl	62.36 cc. M/5 KCl	Dilute to 200 cc.
1.6	29.90 cc. M/5 HCl	70.06 cc. M/5 KCl	Dilute to 200 cc.
1.7	23.76 cc. M/5 HCl	76.24 cc. M/5 KCl	Dilute to 200 cc.
1.8	18.86 cc. M/5 HCl	81.14 cc. M/5 KCl	Dilute to 200 cc.
1.9	14.98 cc. M/5 HCl	85.02 cc. M/5 KCl	Dilute to 200 cc.
2.0	11.90 cc. M/5 HCl	88.10 cc. M/5 KCl	Dilute to 200 cc.
2.1	9.46 cc. M/5 HCl	90.54 cc. M/5 KCl	Dilute to 200 cc.
2.2	7.52 cc. M/5 HCl	92.48 cc. M/5 KCl	Dilute to 200 cc.
pH			
	Phthalate-HCl mixtures		
2.2	50 cc. M/5 KHPhthalate	46.60 cc. M/5 HCl	Dilute to 200 cc.
2.4	50 cc. M/5 KHPhthalate	39.60 cc. M/5 HCl	Dilute to 200 cc.
2.6	50 cc. M/5 KHPhthalate	33.00 cc. M/5 HCl	Dilute to 200 cc.
2.8	50 cc. M/5 KHPhthalate	26.50 cc. M/5 HCl	Dilute to 200 cc.
3.0	50 cc. M/5 KHPhthalate	20.40 cc. M/5 HCl	Dilute to 200 cc.
3.2	50 cc. M/5 KHPhthalate	14.80 cc. M/5 HCl	Dilute to 200 cc.
3.4	50 cc. M/5 KHPhthalate	9.95 cc. M/5 HCl	Dilute to 200 cc.
3.6	50 cc. M/5 KHPhthalate	6.00 cc. M/5 HCl	Dilute to 200 cc.
3.8	50 cc. M/5 KHPhthalate	2.65 cc. M/5 HCl	Dilute to 200 cc.
pH			
	Phthalate-NaOH mixtures		
4.0	50 cc. M/5 KHPhthalate	0.40 cc. M/5 NaOH	Dilute to 200 cc.
4.2	50 cc. M/5 KHPhthalate	3.65 cc. M/5 NaOH	Dilute to 200 cc.
4.4	50 cc. M/5 KHPhthalate	7.35 cc. M/5 NaOH	Dilute to 200 cc.
4.6	50 cc. M/5 KHPhthalate	12.00 cc. M/5 NaOH	Dilute to 200 cc.
4.8	50 cc. M/5 KHPhthalate	17.50 cc. M/5 NaOH	Dilute to 200 cc.
5.0	50 cc. M/5 KHPhthalate	23.65 cc. M/5 NaOH	Dilute to 200 cc.
5.2	50 cc. M/5 KHPhthalate	29.75 cc. M/5 NaOH	Dilute to 200 cc.
5.4	50 cc. M/5 KHPhthalate	35.25 cc. M/5 NaOH	Dilute to 200 cc.
5.6	50 cc. M/5 KHPhthalate	39.70 cc. M/5 NaOH	Dilute to 200 cc.
5.8	50 cc. M/5 KHPhthalate	43.10 cc. M/5 NaOH	Dilute to 200 cc.
6.0	50 cc. M/5 KHPhthalate	45.40 cc. M/5 NaOH	Dilute to 200 cc.
6.2	50 cc. M/5 KHPhthalate	47.00 cc. M/5 NaOH	Dilute to 200 cc.

pH	KH_2PO_4-NaOH mixtures		
5.8	50 cc. M/5 KH_2PO_4	3.66 cc. M/5 NaOH	Dilute to 200 cc.
6.0	50 cc. M/5 KH_2PO_4	5.64 cc. M/5 NaOH	Dilute to 200 cc.
6.2	50 cc. M/5 KH_2PO_4	8.55 cc. M/5 NaOH	Dilute to 200 cc.
6.4	50 cc. M/5 KH_2PO_4	12.60 cc. M/5 NaOH	Dilute to 200 cc.
6.6	50 cc. M/5 KH_2PO_4	17.74 cc. M/5 NaOH	Dilute to 200 cc.
6.8	50 cc. M/5 KH_2PO_4	23.60 cc. M/5 NaOH	Dilute to 200 cc.
7.0	50 cc. M/5 KH_2PO_4	29.54 cc. M/5 NaOH	Dilute to 200 cc.
7.2	50 cc. M/5 KH_2PO_4	34.90 cc. M/5 NaOH	Dilute to 200 cc.
7.4	50 cc. M/5 KH_2PO_4	39.34 cc. M/5 NaOH	Dilute to 200 cc.
7.6	50 cc. M/5 KH_2PO_4	42.74 cc. M/5 NaOH	Dilute to 200 cc.
7.8	50 cc. M/5 KH_2PO_4	45.17 cc. M/5 NaOH	Dilute to 200 cc.
8.0	50 cc. M/5 KH_2PO_4	46.85 cc. M/5 NaOH	Dilute to 200 cc.
pH	*Boric Acid, KCl-NaOH mixtures*		
7.8	50 cc. M/5 H_3BO_3, M/5 KCl	2.65 cc. M/5 NaOH	Dilute to 200 cc.
8.0	50 cc. M/5 H_3BO_3, M/5 KCl	4.00 cc. M/5 NaOH	Dilute to 200 cc.
8.2	50 cc. M/5 H_3BO_3, M/5 KCl	5.90 cc. M/5 NaOH	Dilute to 200 cc.
8.4	50 cc. M/5 H_3BO_3, M/5 KCl	8.55 cc. M/5 NaOH	Dilute to 200 cc.
8.6	50 cc. M/5 H_3BO_3, M/5 KCl	12.00 cc. M/5 NaOH	Dilute to 200 cc.
8.8	50 cc. M/5 H_3BO_3, M/5 KCl	16.40 cc. M/5 NaOH	Dilute to 200 cc.
9.0	50 cc. M/5 H_3BO_3, M/5 KCl	21.40 cc. M/5 NaOH	Dilute to 200 cc.
9.2	50 cc. M/5 H_3BO_3, M/5 KCl	26.70 cc. M/5 NaOH	Dilute to 200 cc.
9.4	50 cc. M/5 H_3BO_3, M/5 KCl	32.00 cc. M/5 NaOH	Dilute to 200 cc.
9.6	50 cc. M/5 H_3BO_3, M/5 KCl	36.85 cc. M/5 NaOH	Dilute to 200 cc.
9.8	50 cc. M/5 H_3BO_3, M/5 KCl	40.80 cc. M/5 NaOH	Dilute to 200 cc.
10.0	50 cc. M/5 H_3BO_3, M/5 KCl	43.90 cc. M/5 NaOH	Dilute to 200 cc.

Hydrogen-Ion Concentration (pH) of Some Official Substances

The hydrogen-ion concentrations, expressed as pH, of the substances in the following table are given for informative purposes only, and are not intended to be construed as a means for the determination of the purity of these substances. In practice, variations from these figures may frequently be found, as a slight excess of acid or base is, in many instances, desirable and even necessary to insure stability and other qualities in connection with the use of these substances.

When only one figure is given in the table it represents the theoretical pH, or the one generally agreed upon in the literature. For the majority of the alkali-and alkaline earth-salts an approximate range is given within which the pH of these substances, as they usually occur on the market, will fall. Some deviations from these values may, however, be expected, as the presence of even a very slight excess of base or acid in these salts, or of carbon dioxide in their solutions, exercises a pronounced influence upon the hydrogen-ion concentration.

Substance	*Concentration*	pH
Acid acetic	0.1 molar	2.9
Acid benzoic	Saturated solution	2.8
Acid boric	0.1 molar	5.1
Acid citric	0.1 molar	2.1
Acid hydriodic	0.1 molar	1.0
Acid hydrochloric	0.1 molar	1.0
Acid hypophosphorous	0.1 molar	1.5
Acid lactic	0.1 molar	2.4
Acid nitric	0.1 molar	1.1
Acid phosphoric	0.1 molar	1.5
Acid salicylic	Saturated solution	2.4
Acid sulfuric	0.05 molar	1.2
Acid tartaric	0.1 molar	1.9

Substance	*Concentration*	pH
Acid trichloroacetic	0.1 molar	1.2
Alum (ammonium)	0.05 molar	4.6
Alum (potassium)	0.1 molar	4.2
Ammonium bromide	0.1 molar	4.6
Ammonium chloride	0.1 molar	4.6
Ammonia water	0.1 molar	11.3
Apomorphine hydrochloride	1 in 300	4.8
Arsphenamine	1 in 20	3.0
Atropine	Saturated solution	9.5
Atropine sulfate	1 in 100	5.4
Barbital sodium	0.1 molar	9.4
Caffeine citrated	1 in 25	2.3
Caffeine with sodium benzoate	1 in 25	7.4
Calcium bromide	0.2 molar	7.0–8.0
Calcium chloride	0.2 molar	6.5–7.5
Calcium hydroxide	Saturated solution	12.3
Calcium lactate	1 in 25	6.0–7.0
Cinchonidine sulfate	Saturated solution	6.4
Cocaine hydrochloride	0.1 molar	4.5
Codeine	Saturated solution	9.8
Codeine phosphate	0.1 molar	4.5
Codeine sulfate	0.1 molar	5.0
Emetine hydrochloride	1 in 50	5.6
Ephedrine	1 in 200	10.8
Ephedrine hydrochloride	1 in 200	5.9
Homatropine hydrobromide	1 in 100	5.4
Magma magnesia		10.6
Magnesium sulfate	0.2 molar	6.0–7.0
Morphine sulfate	0.1 molar	4.8
Physostigmine salicylate	1 in 200	5.8
Pilocarpine nitrate	1 in 100	4.8
Potassium acetate	0.1 molar	9.7
Potassium bicarbonate	0.1 molar	8.2
Potassium bromide	0.2 molar	6.5–8.0
Potassium carbonate	0.1 molar	11.6
Potassium hydroxide	0.1 molar	13.5
Potassium iodide	0.2 molar	7.0–9.0
Potassium nitrate	0.2 molar	6.5–7.5
Potassium and sodium tartrate	0.2 molar	7.0–8.0
Procaine hydrochloride	0.1 molar	6.0
Quinidine sulfate	1 in 200	6.4
Quinine	Saturated solution	8.8
Quinine bisulfate	1 in 25	3.5
Quinine dihydrochloride	1 in 25	2.6
Quinine hydrobromide	1 in 25	6.4
Quinine hydrochloride	1 in 25	6.4
Quinine sulfate	Saturated solution	6.2
Quinine and urea hydrochloride	1 in 20	3.1
Sodium acetate	0.1 molar	8.9
Sodium benzoate	0.1 molar	8.0
Sodium bicarbonate	0.1 molar	8.2
Sodium biphosphate	0.1 molar	4.5
Sodium borate	0.1 molar	9.2
Sodium bromide	0.2 molar	6.5–8.0

Substance	*Concentration*	pH
Sodium cacodylate	0.1 molar	7.8
Sodium carbonate	0.1 molar	11.6
Sodium chloride	0.2 molar	6.7–7.3
Sodium hydroxide	0.1 molar	13.5
Sodium iodide	0.2 molar	8.0–9.5
Sodium phosphate (dibasic)	0.1 molar	9.5
Sodium salicylate	0.2 molar	5.0–6.0
Sodium sulfadiazine	0.01 molar	8.75
Sodium sulfadiazine	Saturated solution	9.90
Sodium sulfapyridine	0.01 molar	10.10
Sodium sulfapyridine	Saturated solution	10.85
Sodium sulfathiazole	0.01 molar	9.20
Sodium sulfathiazole	Saturated solution	9.65
Sodium sulfate	0.2 molar	6.0–7.5
Sodium thiosulfate	0.2 molar	6.5–8.0
Strychnine nitrate	1 in 250	5.7
Strychnine sulfate	1 in 100	5.5
Sulfadiazine	Saturated solution	5.75
Sulfanilamide	Saturated solution	7.15
Sulfapyridine	Saturated solution	6.65
Sulfathiazole	Saturated solution	5.90
Theobromine with sodium salicylate	1 in 100	10.3

Natural numbers	0	1	2	3	4	5	6	7	8	9	Proportional parts								
											1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7

Natural numbers	0	1	2	3	4	5	6	7	8	9	Proportional parts 1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9026	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

Section II. CHEMICAL DATA

Atomic Weights

Adopted by the International Committee on Chemical Elements (1941)

Oxygen 16.0000

Name	Symbol	Atomic number	Atomic weight	Name	Symbol	Atomic number	Atomic weight
Aluminum	Al	13	26.97	Molybdenum	Mo	42	95.95
Antimony	Sb	51	121.76	Neodymium	Nd	60	144.27
Argon	A	18	39.944	Neon	Ne	10	20.183
Arsenic	As	33	74.91	Nickel	Ni	28	58.69
Barium	Ba	56	137.36	Nitrogen	N	7	14.008
Beryllium	Be	4	9.02	Osmium	Os	76	190.2
Bismuth	Bi	83	209.00	Oxygen	O	8	16.0000
Boron	B	5	10.82	Palladium	Pd	46	106.7
Bromine	Br	35	79.916	Phosphorus	P	15	30.98
Cadmium	Cd	48	112.41	Platinum	Pt	78	195.23
Calcium	Ca	20	40.08	Potassium	K	19	39.096
Carbon	C	6	12.010	Praseodymium	Pr	59	140.92
Cerium	Ce	58	140.13	Protactinium	Pa	91	231
Cesium	Cs	55	132.91	Radium	Ra	88	226.05
Chlorine	Cl	17	35.457	Radon	Rn	86	222
Chromium	Cr	24	52.01	Rhenium	Re	75	186.31
Cobalt	Co	27	58.94	Rhodium	Rh	45	102.91
Columbium	Cb	41	92.91	Rubidium	Rb	37	85.48
Copper	Cu	29	63.57	Ruthenium	Ru	44	101.7
Dysprosium	Dy	66	162.46	Samarium	Sm	62	150.43
Erbium	Er	68	167.2	Scandium	Sc	21	45.10
Europium	Eu	63	152.0	Selenium	Se	34	78.96
Fluorine	F	9	19.00	Silicon	Si	14	28.06
Gadolinium	Gd	64	156.9	Silver	Ag	47	107.880
Gallium	Ga	31	69.72	Sodium	Na	11	22.997
Germanium	Ge	32	72.60	Strontium	Sr	38	87.63
Gold	Au	79	197.2	Sulfur	S	16	32.06
Hafnium	Hf	72	178.6	Tantalum	Ta	73	180.88
Helium	He	2	4.003	Tellurium	Te	52	127.61
Holmium	Ho	67	164.94	Terbium	Tb	65	159.2
Hydrogen	H	1	1.0080	Thallium	Tl	81	204.39
Indium	In	49	114.76	Thorium	Th	90	232.12
Iodine	I	53	126.92	Thulium	Tm	69	169.4
Iridium	Ir	77	193.1	Tin	Sn	50	118.70
Iron	Fe	26	55.85	Titanium	Ti	22	47.90
Krypton	Kr	36	83.7	Tungsten	W	74	183.92
Lanthanum	La	57	138.92	Uranium	U	92	238.07
Lead	Pb	82	207.21	Vanadium	V	23	50.95
Lithium	Li	3	6.940	Xenon	Xe	54	131.3
Lutecium	Lu	71	174.99	Ytterbium	Yb	70	173.04
Magnesium	Mg	12	24.32	Yttrium	Y	39	88.92
Manganese	Mn	25	54.93	Zinc	Zn	30	65.38
Mercury	Hg	80	200.61	Zirconium	Zr	40	91.22

Atomic and Molecular Weights

Acetaldehyde (acetic aldehyde)	CH_3CHO	44.05
Acetanilid	$C_6H_5NH.CH_3CO$	135.16
Acetic anhydride	$(CH_3CO)_2O$	102.09
Acetone	$(CH_3)_2CO$	58.08
Acetophenetidin	$C_{10}H_{13}O_2N$	179.21
Acetylcholine chloride	$CH_3CO.OCH_2CH_2(CH_3)_3N.Cl$	181.663
Acid, acetic	$HC_2H_3O_2$	60.05

—— —— anhydride (*See* Acetic anhydride.)

Acid, acetylsalicylic	$HC_7H_4O_2C_2H_3O_2$	180.15
—— aminoacetic	$C_2H_5O_2N$	75.07
—— aminonaphthosulfonic	1,2,4-$HC_{10}H_8O_4NS.\frac{1}{2}H_2O$	248.25
—— arsenic	$H_3AsO_4.\frac{1}{2}H_2O$	150.94
—— ascorbic	$C_6H_8O_6$	176.12
—— aurochloric (chlorauric acid)	$HAuCl_4.4H_2O$	412.10
—— benzoic	$HC_7H_5O_2$	122.12
—— boric	H_3BO_3	61.84
—— bromauric (aurobromhydric acid)	$HAuBr_4.5H_2O$	607.95
—— butyric	$HC_4H_7O_2$	88.10
—— chlorauric (*See* Aurochloric acid.)		
—— chloroplatinic	$H_2PtCl_6.6H_2O$	518.08
—— cholic	$C_{24}H_{40}O_5$	308.56
—— chromic (chromium trioxide)	CrO_3	100.01
—— cinnamic (cinnamylic acid)	$HC_9H_7O_2$	148.15
—— citric	$H_3C_6H_5O_7.H_2O$	210.14
—— ——anhydrous	$H_3C_6H_5O_7$	192.12
—— diethyl-barbituric (*See* Barbital.)		
—— 3,5-dinitrosalicylic	$HC_7H_3N_2O_7.H_2O$	246.13
—— formic	$HCHO_2$	46.03
—— gallic	$HC_7H_5O_5.H_2O$	188.13
—— —— anhydrous	$HC_7H_5O_5$	170.12
—— hydriodic (*See* Hydrogen iodide)	HI+water	
—— hydrobromic (*See* Hydrogen bromide)	HBr+water	
—— hydrochloric (*See* Hydrogen chloride)	HCl+water	
—— hydrocyanic (*See* Hydrogen cyanide)	HCN+water	
—— hypophosphorous	HPH_2O_2	66.00
—— iodic	HIO_3	175.93
—— iodooxyquinolinesulfonic 7–8–5	$C_9H_6INSO_4$	351.13
—— lactic	$HC_3H_5O_3$	90.08
—— mandelic	$HC_8H_7O_3$	152.14
—— molybdic	H_2MoO_4	161.97
—— nicotinic	$HC_6H_4O_2N$	123.11
—— nitric	HNO_3	63.02
—— oleic	$HC_{18}H_{33}O_2$	282.45
—— oxalic	$H_2C_2O_4.2H_2O$	126.07
—— —— anhydrous	$H_2C_2O_4$	90.04
—— palmitic	$HC_{16}H_{31}O_2$	256.42
—— perchloric	$HClO_4$	100.47
—— phenoldisulfonic	$H_2C_6H_3(SO_3)_2OH$	254.23
—— phenylcinchoninic (*See* Cinchophen.)		
—— phosphomolybdic (approx.)	$P_2O_5.24MoO_3.51H_2O$	4515.58
—— phosphoric	H_3PO_4	98.00
—— phosphorous	H_2PHO_3	82.00
—— phosphotungstic (approx.)	$P_2O_512WO_3.42H_2O$	3681.67

Acid, picric (*See* Trinitrophenol.)		
—— picrolonic	$C_{10}H_8N_4O_5$	264.20
—— pyrogallic (*See* Pyrogallol.)		
—— salicylic	$HC_7H_5O_3$	138.12
—— selenous	H_2SeO_3	128.98
—— stearic	$HC_{18}H_{35}O_2$	284.47
—— sulfanilic	$HC_6H_4(NH_2)SO_3.1H_2O$	191.20
—— sulfosalicylic	$HC_7H_5O_6S.2H_2O$	254.21
—— sulfuric	H_2SO_4	98.08
—— tartaric	$H_2C_4H_4O_6$	150.09
—— trichloroacetic	$HC_2Cl_3O_2$	163.40
—— uric	$C_5H_4N_4O_3$	168.11
—— valeric (valerianic acid)	$HC_5H_9O_2$	102.13
Aconitine	$C_{34}H_{47}NO_{11}$	645.72
Alcohol (ethyl)	C_2H_5OH	46.07
Allyl isothiocyanate	C_3H_5NCS	99.15
Allyl-thiocarbamide (thiosinamine)	$C_3H_5N_2CSH_3$	116.18
Alum (*See* Aluminum and potassium sulfate and Aluminum and ammonium sulfate.)		
Aluminum	**Al**	**26.97**
Aluminum and ammonium sulfate (alum)	$AlNH_4(SO_4)_2.12H_2O$	453.32
Aluminum and ammonium sulfate anhydrous	$AlNH_4(SO_4)_2$	237.13
Aluminum and potassium sulfate (alum)	$AlK(SO_4)_2.12H_2O$	474.38
Aluminum and potassium sulfate anhydrous	$AlK(SO_4)_2$	258.19
Aluminum hydroxide	$Al(OH)_3$	77.99
—— oxide	Al_2O_3	101.94
—— sulfate	$Al_2(SO_4)_3.18H_2O$	666.41
—— —— anhydrous	$Al_2(SO_4)_3$	342.12
Amaranth	$C_{20}H_{11}N_2O_{10}SNa_3$	604.48
p-Aminoacetophenone	C_8H_9NO	135.16
Aminopyrine	$C_{13}H_{17}ON_3$	231.29
Ammonia	NH_3	17.03
Ammonium acetate	$NH_4C_2H_3O_2$	77.08
—— benzoate	$NH_4C_7H_5O_2$	139.15
—— bicarbonate	NH_4HCO_3	79.06
—— bromide	NH_4Br	97.96
—— carbamate	$NH_4NH_2CO_2$	78.07
—— carbonate (normal)	$(NH_4)_2CO_3$	96.09
—— —— (U. S. P.) (approx.)	$NH_4HCO_3NH_4NH_2CO_2$	157.13
—— chloride	NH_4Cl	53.50
—— citrate, dibasic	$(NH_4)_2HC_6H_5O_7$	226.19
—— hydroxide	NH_4OH	35.05
—— hypophosphite	$NH_4PH_2O_2$	83.04
—— iodide	NH_4I	144.96
—— molybdate	$(NH_4)_6Mo_7O_{24}.4H_2O$	1235.95
—— nitrate	NH_4NO_3	80.05
—— oxalate	$(NH_4)_2C_2O_4.H_2O$	142.12

Ammonium oxalate anhydrous	$(NH_4)_2C_2O_4$	124.10
—— phosphate	$(NH_4)_2HPO_4$	132.07
—— salicylate	$NH_4C_7H_5O_3$	155.15
—— sodium phosphate (*See* Sodium ammonium phosphate.)		
—— sulfate	$(NH_4)_2SO_4$	132.14
—— sulfide	$(NH_4)_2S$	68.14
—— tartrate	$(NH_4)_2C_4H_4O_6$	184.15
—— thiocyanate	NH_4SCN	76.12
—— vanadate (metavanadate)	NH_4VO_3	116.99
Amyl alcohol (*See* Isoamyl alcohol.)		
—— nitrite	$C_5H_{11}NO_2$	117.15
Amylene hydrate	$C_5H_{11}OH$	88.15
Anethol	$C_{10}H_{12}O$	148.20
Aniline (phenylamine)	$C_6H_5NH_2$	93.12
—— sulfate	$(C_6H_5NH_2)_2H_2SO_4$	284.32
Antimonous oxide	Sb_2O_3	291.52
Antimony	**Sb**	**121.76**
Antimony and potassium tartrate	$K(SbO)C_4H_4O_6.\frac{1}{2}H_2O$	333.94
—— —— —— —— anhydrous	$K(SbO)C_4H_4O_6$	324.93
Antipyrine	$C_{11}H_{12}N_2O$	188.22
Apomorphine hydrochloride	$C_{17}H_{17}O_2NHCl.\frac{1}{2}H_2O$	312.79
Argon	**A**	**39.944**
Arsenic	**As**	**74.91**
Arsenic pentoxide (arsenic acid anhydride)	As_2O_5	229.82
—— trioxide (*See* Arsenous oxide.)		
Arsenous iodide (arsenic triiodide)	AsI_3	455.67
—— oxide (arsenic trioxide)	As_2O_3	197.82
—— sulfide	As_2S_3	246.00
Arspheramine	$C_{12}H_{12}O_2N_2As_2.2HCl.2H_2O$	475.01
Ascaridol	$C_{10}H_{16}O_2$	168.23
Aspidospermine	$C_{22}H_{30}N_2O_2$	354.48
Atropine	$C_{17}H_{23}O_3N$	289.36
—— sulfate	$(C_{17}H_{23}O_3N)_2H_2SO_4.H_2O$	694.82
Auric chloride	$AuCl_3$	303.57
Azure A (methylene azure)	$C_{14}H_{14}ClN_3S$	291.79
Barbital	$C_8H_{12}N_2O_3$	184.19
—— sodium	$C_8H_{11}N_2O_3Na$	206.18
Barium	**Ba**	**137.36**
Barium carbonate	$BaCO_3$	197.37
—— chloride	$BaCl_2.2H_2O$	244.31
—— —— anhydrous	$BaCl_2$	208.27
—— chromate	$BaCrO_4$	253.37
—— hydroxide	$Ba(OH)_2.8H_2O$	315.50
—— nitrate	$Ba(NO_3)_2$	261.38
—— sulfate	$BaSO_4$	233.42
Benzaldehyde	C_6H_5CHO	106.12
Benzene (benzol)	C_6H_6	78.11
Benzidine	$(C_6H_4)_2(NH_2)_2$	184.23
Benzocaine (*See* Ethyl aminobenzoate.)		

Benzosulfimide (*See* Saccharin.)		
Beryllium (glucinum)	**Be**	**9.02**
Betaeucaine hydrochloride (*See* Eucaine hydrochloride.)		
Betanaphthol	$C_{10}H_7OH$	144.16
Bismuth	**Bi**	**209.00**
Bismuth citrate	$BiC_6H_5O_7$	398.10
—— nitrate (normal)	$Bi(NO_3)_3.5H_2O$	485.10
—— phosphate	$BiPO_4$	303.98
—— subcarbonate (approx.)	$[(BiO)_2CO_3]_2.H_2O$	1038.04
—— subgallate (approx.)	$Bi(OH)_2C_7H_5O_5$	412.13
—— subnitrate (approx.)	$Bi(OH)_2NO_3$	305.02
—— subsalicylate (approx.)	$Bi(OH)_2C_7H_5O_3$	380.13
—— sulfide	Bi_2S_3	514.18
—— trioxide	Bi_2O_3	466.00
Borax (*See* Sodium borate.)		
Borneol	$C_{10}H_{17}OH$	154.24
Bornyl acetate	$C_{10}H_{17}C_2H_3O_2$	196.28
Boron	B	10.82
Boron trioxide	B_2O_3	69.64
Bromine	**Br**	**79.916**
Bromoform	$CHBr_3$	252.77
Bromocresol purple	$C_6H_4SO_3C(C_6H_2CH_3BrOH)_2$	540.23
Brucine	$C_{23}H_{26}N_2O_4.4H_2O$	466.52
—— anhydrous	$C_{23}H_{26}N_2O_4$	394.45
Butacaine sulfate	$(C_{18}H_{30}N_2O_2)_2.H_2SO_4$	710.95
Butyl aminobenzoate	$C_{11}H_{15}O_2N$	193.24
Cadmium	**Cd**	**112.41**
Cadmium chloride	$CdCl_2.2H_2O$	219.36
—— —— anhydrous	$CdCl_2$	183.32
—— iodide	CdI_2	366.25
—— sulfate	$3CdSO_4.8H_2O$	769.54
—— —— anhydrous	$CdSO_4$	208.47
Caffeine	$C_8H_{10}N_4O_2.H_2O$	212.21
—— anhydrous	$C_8H_{10}N_4O_2$	194.19
Calcium	**Ca**	**40.08**
Calcium biphosphate	$Ca(H_2PO_4)_2.H_2O$	252.09
—— bromide	$CaBr_2.2H_2O$	235.94
—— —— anhydrous	$CaBr_2$	199.91
—— carbonate	$CaCO_3$	100.09
—— chloride	$CaCl_2.2H_2O$	147.03
—— —— anhydrous	$CaCl_2$	110.99
—— gluconate	$CaC_{12}H_{22}O_{14}.H_2O$	448.39
—— glycerophosphate	$CaC_3H_7PO_6.H_2O$	228.16
—— —— anhydrous	$CaC_3H_7PO_6$	210.15
—— hydroxide	$Ca(OH)_2$	74.10
—— hypophosphite	$Ca(PH_2O_2)_2$	170.07
—— iodobehenate	$Ca(C_{21}H_{42}ICO_2)_2$	971.03
—— lactate	$Ca(C_3H_5O_3)_2.5H_2O$	308.30
—— —— anhydrous	$Ca(C_3H_5O_3)_2$	218.22
—— mandelate	$Ca(C_8H_7O_3)_2$	342.35
—— oxide (lime)	CaO	56.08
—— phosphate, tribasic	$Ca_3(PO_4)_2$	310.20
—— sulfate	$CaSO_4.2H_2O$	172.17

Calcium sulfate anhydrous	$CaSO_4$	136.14
—— sulfide (monosulfide)	CaS	72.14
Camphor	$C_{10}H_{16}O$	152.23
—— monobromated	$C_{10}H_{15}BrO$	231.14
Capryl alcohol (secondary N-Octanol)	$C_8H_{17}OH$	130.22
Carbarsone	$C_7H_9AsN_2O_4$	260.07
Carbon	**C**	**12.010**
Carbon dioxide	CO_2	44.01
—— disulfide	CS_2	76.13
—— monoxide	CO	28.01
—— tetrachloride	CCl_4	153.84
Carbromal	$C_7H_{13}N_2O_2Br$	237.11
Cephaëline	$C_{14}H_{19}O_2N$	233.30
Cerium	**Ce**	**140.13**
Cerium oxalate	$Ce_2(C_2O_4)_3.10H_2O$	724.48
Ceric sulfate, anhydrous	$Ce(SO_4)_2$	332.25
Cesium	**Cs**	**132.91**
Chloral hydrate	$C_2Cl_3H_3O_2$	165.42
Chloramine-T	$C_7H_7ClNO_2SNa.3H_2O$	281.70
Chloranil (tetrachlorobenzo-quinone)	$C_6Cl_4O_2$	245.89
Chloroazodin	$C_2H_4Cl_2N_6$	183.01
Chlorobutanol	$C_4H_7Cl_3O$	177.47
Chlorine	**Cl**	**35.457**
Chloroform	$CHCl_3$	119.39
Cholesterol (cholesterin)	$C_{27}H_{45}OH$	386.64
Chromium	**Cr**	**52.01**
Chromium oxide	Cr_2O_3	152.02
Chromium trioxide (chromic acid)	CrO_3	100.01
Chromotropic acid	$C_{10}H_8O_8S_2.2H_2O$	356.32
Cinchonidine	$C_{19}H_{22}N_2O$	294.38
—— sulfate	$(C_{19}H_{22}N_2O)_2.H_2SO_4.3H_2O$	740.89
—— —— anhydrous	$(C_{19}H_{22}N_2O)_2.H_2SO_4$	686.84
Cinchonine	$C_{19}H_{22}N_2O$	294.38
Cinchonine sulfate	$(C_{19}H_{22}N_2O)_2H_2SO_4.2H_2O$	722.87
—— sulfate anhydrous	$(C_{19}H_{22}N_2O)_2H_2SO_4$	686.84
Cinchophen (phenylcinchoninic acid)	$HC_{16}H_{10}O_2N$	249.26
Cineol (eucalyptol)	$C_{10}H_{18}O$	154.24
Cinnamic aldehyde	C_9H_8O	132.15
Citral	$C_{10}H_{16}O$	152.23
Cobalt	**Co**	**58.94**
Cobaltous acetate	$Co(C_2H_3O_2)_2.4H_2O$	249.09
—— chloride	$CoCl_2.6H_2O$	237.95
—— —— anhydrous	$CoCl_2$	129.85
—— nitrate	$Co(NO_3)_2.6H_2O$	291.05
—— —— anhydrous	$Co(NO_3)_2$	182.96
—— sulfate	$CoSO_4.7H_2O$	281.11
—— —— (dried)	$CoSO_4.2H_2O$	191.03
Cocaine	$C_{17}H_{21}NO_4$	303.35
—— hydrochloride	$C_{17}H_{21}O_4N.HCl$	339.81

Codeine (methylmorphine)	$C_{18}H_{21}O_3N.H_2O$	317.37
—— anhydrous	$C_{18}H_{21}O_3N$	299.36
—— phosphate	$C_{18}H_{21}O_3NH_3PO_4.1\frac{1}{2}H_2O$	424.39
—— —— anhydrous	$C_{18}H_{21}O_3NH_3PO_4$	397.36
—— sulfate	$(C_{18}H_{21}O_3N)_2H_2SO_4.5H_2O$	786.87
—— —— anhydrous	$(C_{18}H_{21}O_3N)_2H_2SO_4$	696.79
Colchicine	$C_{22}H_{25}NO_6$	399.43
Columbium	**Cb**	**92.91**
Congo red	$C_{32}H_{22}N_6O_6S_2Na_2$	696.66
Coniine	$C_8H_{17}N$	127.22
Copper	**Cu**	**63.57**
Cotarnine	$C_{12}H_{15}O_4N$	237.25
Cotarnine chloride	$C_{12}H_{14}ClO_3N.H_2O$	273.71
Cresol	$C_6H_4(CH_3)OH$	108.13
Crystal violet. (*See* Methylrosaniline chloride.)		
Cupric acetate	$Cu(C_2H_3O_2)_2.H_2O$	199.67
Cupric sulfate	$CuSO_4.5H_2O$	249.71
—— —— anhydrous	$CuSO_4$	159.63
—— sulfide	CuS	95.63
Cyclopropane	C_3H_6	42.08
l-Cystine	$C_6H_{12}N_2O_4S_2$	240.29
Dextrose	$C_6H_{12}O_6.H_2O$	198.17
—— anhydrous	$C_6H_{12}O_6$	180.16
Dihydromorphinone hydrochloride	$C_{17}H_{19}O_3N.HCl$	321.80
Diiodofluorescein	$C_{20}H_{10}O_5I_2$	584.12
p-Dimethylaminoazobenzene	$C_6H_5NNC_6H_4N(CH_3)_2$	225.28
p-Dimethylaminobenzaldehyde	$(CH_3)_2NC_6H_4CHO$	149.19
Dimethylglyoxime	$(CH_3)_2C_2(NOH)_2$	116.12
Dinitrophenylhydrazine	$2,4\text{-}C_6H_3(NO_2)_2NHNH_2$	198.14
Dioxane	$C_4H_4O_2$	88.10
Dipentene	$C_{10}H_{16}$	136.23
Diphenylamine	$(C_6H_5)_2NH$	169.22
Diphenylhydantoin	$C_{15}H_{12}N_2O_2$	252.25
Diphenylhydantoin sodium	$C_{15}H_{11}N_2O_2Na$	274.25
Dithiazone (diphenylthiocarbazone)	$C_{13}H_{12}N_4S$	256.32
Dithymol diiodide. (*See* Thymol iodide.)		
Dysprosium	**Dy**	**162.46**
Emetine	$C_{29}H_{40}N_2O_4$	480.63
—— hydrochloride, anhydrous	$C_{29}H_{40}N_2O_4.2HCl$	553.56
Eosin Y	$C_{20}H_6Br_4O_5Na_2$	691.91
Ephedrine, anhydrous	$C_{10}H_{15}NO$	165.23
—— hemihydrate	$C_{10}H_{15}NO.\frac{1}{2}H_2O$	174.24
—— hydrochloride	$C_{10}H_{15}NO.HCl$	201.69
—— sulfate	$(C_{10}H_{15}NO)_2.H_2SO_4$	428.53
Epinephrine, anhydrous	$C_9H_{13}O_3N$	183.20
—— hemihydrate	$C_9H_{13}O_3N.\frac{1}{2}H_2O$	192.21
Erbium	**Er**	**167.2**
Ergonovine maleate	$C_{19}H_{23}N_3O_2.C_4H_4O_4$	441.47
Ergotamine tartrate	$(C_{33}H_{35}N_5O_5)_2.H_2C_4H_4O_6$	1313.39

Ergotoxine ethanesulfonate	$C_{35}H_{41}O_6N_5.C_2H_5SO_3H$	737.85
Erythrityl tetranitrate	$C_4H_6(NO_3)_4$	302.12
Estradiol benzoate	$C_{25}H_{28}O_3$	376.47
Estrone	$C_{18}H_{22}O_2$	270.36
Ether (ethyl oxide)	$(C_2H_5)_2O$	74.12
Ethyl acetate	$C_2H_5C_2H_3O_2$	88.10
—— aminobenzoate	$C_9H_{11}O_2N$	165.19
—— carbamate	$CO(OC_2H_5)NH_2$	89.09
—— chaulmoograte	$C_{20}H_{36}O_2$	308.49
—— chloride	C_2H_5Cl	64.52
—— nitrite	$C_2H_5NO_2$	75.07
—— oxide. (*See* Ether.)		
—— cyanoacetate	$C_2H_7O_2N$	113.11
Ethylene	C_2H_4	28.05
Ethylenediamine	$C_2H_4(NH_2)_2$	60.10
Ethylene tetrachloride. (*See* Tetrachloroethylene.)		
Ethylhydrocupreine hydrochloride	$C_{21}H_{28}N_2O_2HCl$	376.92
Ethylmorphine hydrochloride	$C_{19}H_{23}O_3NHCl.2H_2O$	385.88
—— —— anhydrous	$C_{19}H_{23}O_3NHCl$	349.85
Eucaine hydrochloride (beta)	$C_{15}H_{21}O_2NHCl.H_2O$	301.81
—— —— —— anhydrous	$C_{15}H_{21}O_2NHCl$	283.79
Eucalyptol	$C_{10}H_{18}O$	154.24
Eugenol	$C_{10}H_{12}O_2$	164.20
Eucatropine hydrochloride	$C_{17}H_{25}O_3N.HCl$	327.84
Europium	**Eu**	**152.0**
Ferric acetate	$Fe(C_2H_3O_2)_3$	232.98
—— ammonium sulfate	$FeNH_4(SO_4)_2.12H_2O$	482.20
—— —— —— anhydrous	$FeNH_4(SO_4)_2$	266.01
Ferric chloride	$FeCl_3.6H_2O$	270.32
—— —— anhydrous	$FeCl_3$	162.22
—— hydroxide	$Fe(OH)_3$	106.87
—— hypophosphite	$Fe(PH_2O_2)_3$	250.84
—— nitrate	$Fe(NO_3)_3$	241.87
—— oxide	Fe_2O_3	159.70
—— sulfate (tersulfate), anhydrous	$Fe_2(SO_4)_3$	399.88
Ferrous carbonate	$FeCO_3$	115.86
—— iodide	FeI_2	309.69
—— lactate	$Fe(C_3H_5O_3)_2.3H_2O$	288.04
—— oxide	FeO	71.85
—— sulfate	$FeSO_4.7H_2O$	278.02
—— —— anhydrous	$FeSO_4$	151.91
—— —— exsiccated (approx.)	$(FeSO_4)_2.3H_2O$	357.87
—— sulfide	FeS	87.91
Ferrum	**Fe**	**55.85**
Fluorescein (resorcinolphthalein)	$C_{20}H_{12}O_5$	332.30
—— sodium	$C_{20}H_{10}O_5Na_2$	376.27
Fluorine	**F**	**19.00**

Formaldehyde	CH_2O	30.03
Furfural	$C_4H_3O.CHO$	96.08
Gadolinium	**Gd**	**156.9**
Galactose	$C_6H_{12}O_6$	180.16
Gallium	**Ga**	**69.72**
Germanium	**Ge**	**72.60**
Glucose (grape sugar). (*See* Dextrose.)		
Glycerin (glycerol)	$C_3H_5(OH)_3$	92.09
Glyceryl triacetate	$C_9H_{14}O_6$	218.20
—— trinitrate (nitroglycerin)	$C_3H_5(NO_3)_3$	227.09
Gold	**Au**	**197.2**
Gold chloride (chlorauric acid)	$HAuCl_4.4H_2O$	412.10
Hafnium	**Hf**	**178.6**
Helium	**He**	**4.003**
Hexamethylenamine. (*See* Methenamine.)		
Hexylresorcinol	$C_{12}H_{18}O_2$	194.26
Histamine phosphate	$C_5H_9N_3.2H_3PO_4$	307.15
Holmium	**Ho**	**164.94**
Homatropine	$C_{16}H_{21}O_3N$	275.34
—— hydrobromide	$C_{16}H_{21}O_3NHBr$	356.26
Hydrastine	$C_{21}H_{21}O_6N$	383.39
—— hydrochloride	$C_{21}H_{21}O_6NHCl$	419.85
Hydrastinine hydrochloride	$C_{11}H_{11}O_2NHCl$	225.67
Hydrogen	**H**	**1.0080**
Hydrogen bromide	HBr	80.92
—— chloride	HCl	36.47
—— cyanide	HCN	27.03
—— dioxide. (*See* Hydrogen peroxide.)		
—— iodide	HI	127.93
—— peroxide	H_2O_2	34.02
—— sulfide	H_2S	34.08
Hydroxylamine hydrochloride	$NH_2OH.HCl$	69.50
Hyoscine. (*See* Scopolamine.)		
Hyoscyamine	$C_{17}H_{23}O_3N$	289.36
—— hydrobromide	$C_{17}H_{23}O_3NHBr$	370.29
Indigo carmine (*See* Sodium indigotindisulfonate.)		
Indium	**In**	**114.76**
Iodeosin (tetraiodo-fluorescein)	$C_{20}H_8I_4O_5$	835.94
Iodine	**I**	**126.92**
Iodine pentoxide	I_2O_5	333.84
Iodoform	CHI_3	393.78
Iodophthalein sodium	$C_{20}H_8I_4O_4Na_2.3H_2O$	919.99
Iridium	**Ir**	**193.1**
Iron	**Fe**	**55.85**
Iron salts (*See* Ferric and Ferrous.)		
Isatin	$C_8H_5O_2N$	147.13
Isoamyl alcohol	$C_5H_{11}OH$	88.15
Isobutyl alcohol	$(CH_3)_2CHCH_2OH$	74.12
Krypton	**Kr**	**83.7**
Lactose (milk sugar)	$C_{12}H_{22}O_{11}.H_2O$	360.31

Lanthanum	**La**	**138.92**
Lead	**Pb**	**207.21**
Lead acetate	$Pb(C_2H_3O_2)_2.3H_2O$	379.35
—— —— anhydrous	$Pb(C_2H_3O_2)_2$	325.30
—— —— basic (*See* Lead subacetate.)		
—— carbonate, basic	$(PbCO_3)_2Pb(OH)_2$	775.67
—— chloride	$PbCl_2$	278.12
—— chromate	$PbCrO_4$	323.22
—— dioxide	PbO_2	239.21
—— iodide	PbI_2	461.05
—— monoxide (lead oxide)	PbO	223.21
—— nitrate	$Pb(NO_3)_2$	331.23
—— subacetate	$Pb(C_2H_3O_2)_2.2Pb(OH)_2$	807.75
—— sulfate	$PbSO_4$	303.27
—— sulfide	PbS	239.27
Lime. (*See* Calcium oxide.)		
Limonene	$C_{10}H_{16}$	136.23
Linalyl acetate	$C_{10}H_{17}C_2H_3O_2$	196.28
Lithium	**Li**	**6.940**
Lithium benzoate	$LiC_7H_5O_2$	128.05
—— bromide	$LiBr$	86.86
—— carbonate	Li_2CO_3	73.89
—— chloride	$LiCl$	42.40
—— citrate	$Li_3C_6H_5O_7.4H_2O$	281.98
—— salicylate	$LiC_7H_5O_3$	144.05
Lutecium	**Lu**	**174.99**
Magnesia. (*See* Magnesium oxide.)		
Magnesium	**Mg**	**24.32**
Magnesium carbonate, basic (approx.)	$(MgCO_3)_4Mg(OH)_2.5H_2O$	485.74
—— chloride	$MgCl_2.6H_2O$	203.33
—— —— anhydrous	$MgCl_2$	95.23
—— hydroxide	$Mg(OH)_2$	58.34
—— oxide (magnesia)	MgO	40.32
—— phosphate, tribasic	$Mg_3(PO_4)_2.5H_2O$	353.00
—— phosphate, tribasic, anhydrous	$Mg_3(PO_4)_2$	262.92
—— pyrophosphate	$Mg_2P_2O_7$	222.60
—— sulfate	$MgSO_4.7H_2O$	246.49
—— —— anhydrous	$MgSO_4$	120.38
Maltose	$C_{12}H_{22}O_{11}H_2O$	360.31
Manganese	**Mn**	**54.93**
Manganese dioxide	MnO_2	86.93
—— hypophosphite	$Mn(PH_2O_2)_2.H_2O$	202.94
—— trisilicate	$Mg_2Si_3O_8.nH_2O$	
Manganous oxide	MnO	70.93
—— sulfate	$MnSO_4.4H_2O$	223.05
—— —— anhydrous	$MnSO_4$	150.99
Mannitol	$C_6H_8(OH)_6$	182.17
Menadione (2-Methyl-naphthoquinone)	$C_{11}H_8O_2$	172.17
Menthol	$C_{10}H_{19}OH$	156.26
Menthyl acetate	$C_{10}H_{19}C_2H_3O_2$	198.30

Merbaphen	$C_{16}H_{16}ClN_2O_6HgNa$	591.37
Mercurammonium chloride. (*See* Mercury, ammoniated.)		
Mercuric bromide	$HgBr_2$	360.44
—— chloride	$HgCl_2$	271.52
—— iodide	HgI_2	454.45
—— nitrate	$Hg(NO_3)_2.4H_2O$	396.69
—— oxide	HgO	216.61
—— potassium iodide	K_2HgI_4	786.48
—— salicylate	$HgC_7H_4O_3$	336.71
—— succinimide	$Hg(C_4H_4O_2N)_2$	396.77
—— sulfide	HgS	232.67
Mercurous chloride	$HgCl$	236.07
—— iodide	HgI	327.53
—— nitrate	$HgNO_3.H_2O$	280.63
Mercury	**Hg**	**200.61**
Mercury, ammoniated	$HgNH_2Cl$	252.09
Mersalyl	$C_{13}H_{16}HgNO_6Na$	505.87
Metaphenylenediamine hydrochloride	$C_6H_4(NH_2)_22HCl$	181.07
Methanol	CH_3OH	32.04
Methenamine (hexamethylenamine)	$C_6H_{12}N_4$	140.19
Methyl alcohol. (*See* Methanol.)		
Methylene blue. (*See* methylthionine chloride.)		
2-Methyl-naphthoquinone. (*See* Menadione.)		
Methyl orange	$NaC_{14}H_{14}N_3SO_3$	327.33
—— red	$C_{14}H_{14}N_3CO_2H$	269.29
—— salicylate	$CH_3C_7H_5O_3$	152.14
Methylthionine chloride (methylene blue)	$C_{16}H_{18}N_3ClS.3H_2O$	373.89
Molybdenum	**Mo**	**95.95**
Molybdic anhydride	MoO_3	143.95
Morphine	$C_{17}H_{19}O_3N.H_2O$	303.35
—— anhydrous	$C_{17}H_{19}O_3N$	285.33
—— hydrochloride	$C_{17}H_{19}O_3NHCl.3H_2O$	375.84
—— —— anhydrous	$C_{17}H_{19}O_3NHCl$	321.80
—— sulfate	$(C_{17}H_{19}O_3N)_2H_2SO_4.5H_2O$	758.82
—— —— anhydrous	$(C_{17}H_{19}O_3N)_2H_2SO_4$	668.74
Naphthalene	$C_{10}H_8$	128.16
Naphthol. (*See* Betanaphthol.)		
Naphthylamine acetate	$C_{10}H_7NH_2HC_2H_3O_2$	203.23
—— hydrochloride	$C_{10}H_7NH_2HCl$	179.65
Neocinchophen	$C_{19}H_{17}O_2N$	291.33
Neodymium	**Nd**	**144.27**
Neon	**Ne**	**20.183**
Neostigmine bromide	$C_{12}H_{19}BrN_2O_2$	303.20
—— methylsulfate	$C_{13}H_{22}N_2O_6S$	334.38
Nickel	**Ni**	**58.69**
Nickelous oxide	NiO	74.69
—— sulfate	$NiSO_4.7H_2O$	280.86
Nicotinamide	$C_6H_6N_2O$	122.12
Nitric oxide	NO	30.01
Nitrogen	**N**	**14.008**

Nitrogen monoxide. (*See* Nitrous oxide.)		
Nitroglycerin. (*See* Glyceryl trinitrate.)		
Nitrous oxide	N_2O	44.02
Orange G	$C_{16}H_{10}N_2S_2Na$	317.37
Osmium	**Os**	**190.2**
Osmium tetroxide (osmic acid)	OsO_4	254.20
Ouabain	$C_{29}H_{44}O_{12}.8H_2O$	728.77
—— anhydrous	$C_{29}H_{44}O_{12}$	584.64
Oxygen	**O**	**16.000**
Palladium	**Pd**	**106.7**
Palladous chloride	$PdCl_2$	177.61
Pamaquine naphthoate	$C_{42}H_{45}N_3O_7$	703.80
Paraformaldehyde (trioxymethylene)	$(CH_2O)_3$	90.08
Paraldehyde	$C_6H_{12}O_3$	132.16
Pentobarbital sodium	$C_{11}H_{17}N_2O_3Na$	248.26
Phenacaine hydrochloride	$C_{18}H_{22}N_2O_2.HCl.H_2O$	352.85
o-Phenanthroline	$C_{12}H_8N_2.H_2O$	198.22
Phenobarbital	$C_{12}H_{12}N_2O_3$	232.23
—— sodium	$C_{12}H_{11}N_2O_3Na$	254.22
Phenol	C_6H_5OH	94.11
Phenolphthalein	$C_{20}H_{14}O_4$	318.31
Phenolsulfonphthalein	$C_{19}H_{14}O_5S$	354.36
Phenylhydrazine	$C_6H_5NHNH_2$	108.14
—— hydrochloride	$C_6H_5NHNH_2HCl$	144.61
Phenyl salicylate (salol)	$C_6H_5C_7H_5O_3$	214.21
Phloroglucinol	$C_6H_3(OH)_3.2H_2O$	162.14
Phosphorus	**P**	**30.98**
—— pentoxide (phosphoric anhydride)	P_2O_5	141.96
Physostigmine	$C_{15}H_{21}N_3O_2$	275.34
—— salicylate	$C_{15}H_{21}N_3O_2C_7H_6O_3$	413.46
—— sulfate	$(C_{15}H_{21}N_3O_2)_2H_2SO_4$	648.76
Picrotoxin	$C_{30}H_{34}O_{13}$	602.57
Pilocarpine	$C_{11}H_{16}N_2O_2$	208.25
—— hydrochloride	$C_{11}H_{16}N_2O_2HCl$	244.72
Pilocarpine nitrate	$C_{11}H_{16}N_2O_2HNO_3$	271.27
Piperine	$C_{17}H_{19}O_3N$	285.33
Platinic chloride. (*See* Acid, chloroplatinic.)		
Platinum	**Pt**	**195.23**
Potassium	**K**	**39.096**
Potassium acetate	$KC_2H_3O_2$	98.14
—— arsenite (metarsenite)	$KAsO_2$	146.01
—— bicarbonate	$KHCO_3$	100.11
—— bichromate. (*See* Potassium dichromate.)		
—— biphosphate. (*See* Potassium phosphate, monobasic.)		
—— biphthalate	$KHC_8H_4O_4$	204.22
—— bisulfate	$KHSO_4$	136.16
—— bitartrate	$KHC_4H_4O_6$	188.18
—— bromate	$KBrO_3$	167.01
—— bromide	KBr	119.01
—— carbonate, anhydrous	K_2CO_3	138.20

Potassium carbonate, sesquihydrate	$K_2CO_3.1\frac{1}{2}H_2O$	165.23
—— chlorate	$KClO_3$	122.55
—— chloride	KCl	74.55
—— chromate	K_2CrO_4	194.20
—— citrate	$K_3C_6H_5O_7.H_2O$	324.40
—— —— anhydrous	$K_3C_6H_5O_7$	306.39
—— cyanide	KCN	65.11
—— dichromate (bichromate)	$K_2Cr_2O_7$	294.21
—— ferricyanide	$K_3Fe(CN)_6$	329.25
—— ferrocyanide	$K_4Fe(CN)_6.3H_2O$	422.39
—— fluoride	$KF.2H_2O$	94.13
—— hydroxide	KOH	56.10
—— hypophosphite	KPH_2O_2	104.09
—— iodate	KIO_3	214.02
—— iodide	KI	166.02
—— nitrate	KNO_3	101.10
—— nitrite	KNO_2	85.10
—— oxalate	$K_2C_2O_4.H_2O$	184.23
—— perchlorate	$KClO_4$	138.55
—— permanganate	$KMnO_4$	158.03
—— phosphate, monobasic	KH_2PO_4	136.09
—— —— dibasic	K_2HPO_4	174.18
—— sodium tartrate	$KNaC_4H_4O_6.4H_2O$	282.23
—— —— —— anhydrous	$KNaC_4H_4O_6$	210.17
—— sulfate	K_2SO_4	174.25
—— tartrate	$K_2C_4H_4O_6.\frac{1}{2}H_2O$	235.27
—— —— anhydrous	$K_2C_4H_4O_6$	226.26
—— thiocyanate	$KSCN$	97.17
Praseodymium	**Pr**	**140.92**
Procaine hydrochloride	$C_{13}H_{20}N_2O_2.HCl$	272.77
Protactinium	**Pa**	**231.**
Pyridine	C_5H_5N	79.10
Pyrogallol (pyrogallic acid)	$C_6H_3(OH)_3$	126.11
Quinacrine hydrochloride	$C_{23}H_{30}ClN_3O.2HCl.2H_2O$	508.91
—— —— anhydrous	$C_{23}H_{30}ClN_3O.2HCl$	472.89
Quinidine	$C_{20}H_{24}N_2O_2$	324.41
—— sulfate	$(C_{20}H_{24}N_2O_2)_2H_2SO_4.2H_2O$	782.92
—— —— anhydrous	$(C_{20}H_{24}N_2O_2)_2H_2SO_4$	746.89
Quinine	$C_{20}H_{24}N_2O_2.3H_2O$	378.46
—— anhydrous	$C_{20}H_{24}N_2O_2$	324.41
—— bisulfate	$C_{20}H_{24}N_2O_2H_2SO_4.7H_2O$	548.60
—— —— anhydrous	$C_{20}H_{24}N_2O_2H_2SO_4$	422.48
—— dihydrochloride	$C_{20}H_{24}N_2O_2.2HCl$	397.34
—— ethyl carbonate	$C_{20}H_{23}N_2O_2.CO_2.C_2H_5$	396.47
—— hydrochloride	$C_{20}H_{24}N_2O_2HCl.2H_2O$	396.91
—— —— anhydrous	$C_{20}H_{24}N_2O_2HCl$	360.87
—— salicylate	$C_{20}H_{24}N_2O_2C_7H_6O_3.H_2O$	480.54
—— —— anhydrous	$C_{20}H_{24}N\ O_2C_7H_6O_3$	462.53
—— sulfate	$(C_{20}H_{24}N_2O_2)_2H_2SO_4.2H_2O$	782.92
—— —— anhydrous	$(C_{20}H_{24}N_2O_2)_2H_2SO_4$	746.89

Quinine and urea hydrochloride	$C_{20}H_{24}N_2O_2HCl.CO(NH_2)_2$-HCl.$5H_2O$	547.48
Radium	**Ra**	**226.05**
Radon	**Rn**	**222.**
Resorcinol (resorcin)	$C_6H_4(OH)_2$	110.11
Resorcinolphthalein. (*See* Fluorescein.)		
Rhenium	**Re**	**186.31**
Rhodium	**Rh**	**102.91**
Riboflavin	$C_{17}H_{20}N_4O_6$	376.36
Rubidium	**Rb**	**85.48**
Ruthenium	**Ru**	**101.7**
Saccharin	$C_7H_5O_3NS$	183.18
—— sodium	$C_7H_4O_3NSNa.2H_2O$	241.20
Safrol	$C_{10}H_{10}O_2$	162.18
Salicin	$C_{13}H_{18}O_7$	286.27
Salicylaldehyde (*o*-Hydroxybenzaldehyde)	HOC_6H_4CHO	122.12
Salol. (*See* Phenyl salicylate.)		
Samarium	**Sm**	**150.43**
Santalol	$C_{15}H_{24}O$	220.34
Santonin	$C_{15}H_{18}O_3$	246.29
Scandium	**Sc**	**45.10**
Scopolamine (hyoscine)	$C_{17}H_{21}NO_4$	303.35
—— hydrobromide	$C_{17}H_{21}NO_4HBr.3H_2O$	438.32
—— —— anhydrous	$C_{17}H_{21}NO_4HBr$	384.27
Selenium	**Se**	**78.96**
Silicon	**Si**	**28.06**
Silicon dioxide (silica)	SiO_2	60.06
Silver	**Ag**	**107.880**
Silver chloride	AgCl	143.34
—— cyanide	AgCN	133.90
—— iodide	AgI	234.80
—— nitrate	$AgNO_3$	169.89
—— nitrite	$AgNO_2$	153.89
—— oxide	Ag_2O	231.76
—— sulfate	Ag_2SO_4	311.82
—— sulfide	Ag_2S	247.82
Sodium	**Na**	**22.997**
Sodium acetate	$NaC_2H_3O_2.3H_2O$	136.09
—— —— anhydrous	$NaC_2H_3O_2$	82.04
—— alizarinsulfonate	$C_{14}H_5O_2(OH)_2SO_3Na.H_2O$	360.27
—— ammonium phosphate	$NaNH_4HPO_4.4H_2O$	209.09
—— arsenate	$Na_2HAsO_4.7H_2O$	312.02
—— —— anhydrous	Na_2HAsO_4	185.91
—— arsenite (metarsenite)	$NaAsO_2$	129.91
—— benzoate	$NaC_7H_5O_2$	144.11
—— bicarbonate	$NaHCO_3$	84.02
—— biphosphate	$NaH_2PO_4.H_2O$	138.01
—— —— anhydrous	NaH_2PO_4	119.99
—— bisulfite	$NaHSO_3$	104.07
—— bitartrate	$NaHC_4H_4O_6.H_2O$	190.09
—— borate	$Na_2B_4O_7.10H_2O$	381.43
—— —— anhydrous	$Na_2B_4O_7$	201.27

Sodium bromide	$NaBr$	102.91
—— cacodylate	$Na(CH_3)_2AsO_2.3H_2O$	214.02
—— —— anhydrous	$Na(CH_3)_2AsO_2$	159.98
—— carbonate, anhydrous	Na_2CO_3	106.00
—— carbonate monohydrated	$Na_2CO_3.H_2O$	124.02
—— chloride	$NaCl$	58.45
—— citrate	$Na_3C_6H_5O_7.2H_2O$	294.12
—— —— anhydrous	$Na_3C_6H_5O_7$	258.09
—— cobalti-nitrite	$Co_2(NO_2)_6 6NaNO_2.H_2O$	825.97
—— cyanide	$NaCN$	49.02
—— dichromate	$Na_2Cr_2O_7.2H_2O$	298.05
—— diethyl-dithiocarbamate	$(C_2H_5)_2N.CS_2Na$	171.26
—— fluoride	NaF	42.00
—— hydrosulfite	$Na_2S_2O_4$	174.11
—— hydroxide	$NaOH$	40.01
—— hypochlorite	$NaClO$	74.45
—— hypophosphite	$NaPH_2O_2.H_2O$	106.01
—— —— anhydrous	$NaPH_2O_2$	87.99
—— indigotindisulfonate	$C_{16}H_8O_2N_2(SO_3Na)_2$	466.35
—— iodide	NaI	149.92
—— nitrate	$NaNO_3$	85.01
—— nitrite	$NaNO_2$	69.01
—— nitroprusside	$Na_2Fe(NO)(CN)_5.2H_2O$	297.97
—— oxalate	$Na_2C_2O_4$	134.01
—— perborate	$NaBO_3.4H_2O$	153.88
—— —— anhydrous	$NaBO_3$	81.82
—— peroxide	Na_2O_2	77.99
—— phenolsulfonate (sulfocarbolate)	$NaC_6H_4OH.SO_3.2H_2O$	232.19
—— —— anhydrous	$NaC_6H_4OH.SO_3$	196.16
—— phosphate, dibasic	$Na_2HPO_4.7H_2O$	268.09
—— —— —— anhydrous	Na_2HPO_4	141.98
—— pyrophosphate	$Na_4P_2O_7.10H_2O$	446.11
—— —— anhydrous	$Na_4P_2O_7$	265.95
—— salicylate	$NaC_7H_5O_3$	160.11
—— sulfate	$Na_2SO_4.10H_2O$	322.21
—— —— anhydrous	Na_2SO_4	142.05
—— sulfide	$Na_2S.9H_2O$	240.20
—— sulfite, anhydrous	Na_2SO_3	126.05
—— sulfocarbolate. (*See* Sodium phenolsulfonate.)		
—— tartrate	$Na_2C_4H_4O_6.2H_2O$	230.10
—— —— anhydrous	$Na_2C_4H_4O_6$	194.07
—— tetraborate. (*See* Sodium borate.)		
—— tetrabromofluorescein. (*See* Eosin Y.)		
—— thiosulfate	$Na_2S_2O_3.5H_2O$	248.19
—— —— anhydrous	$Na_2S_2O_3$	158.11
—— tungstate	$Na_2WO_4.2H_2O$	329.95
Sparteine	$C_{15}H_{26}N_2$	234.37
—— sulfate	$C_{15}H_{26}N_2H_2SO_4.5H_2O$	422.53
—— —— anhydrous	$C_{15}H_{26}N_2H_2SO_4$	332.45
Stannous chloride	$SnCl_2.2H_2O$	225.65
—— —— anhydrous	$SnCl_2$	189.61

Stannous sulfide	SnS	150.76
Strontium	**Sr**	**87.63**
Strontium bromide	$SrBr_2.6H_2O$	355.56
—— chloride	$SrCl_2.6H_2O$	266.64
—— iodide	$SrI_2.6H_2O$	449.57
—— salicylate	$Sr(C_7H_5O_3)_2.2H_2O$	397.88
—— sulfate	$SrSO_4$	183.69
Strychnine	$C_{21}H_{22}N_2O_2$	334.40
—— nitrate	$C_{21}H_{22}N_2O_2HNO_3$	397.42
—— sulfate	$(C_{21}H_{22}N_2O_2)_2H_2SO_4.5H_2O$	856.96
—— —— anhydrous	$(C_{21}H_{22}N_2O_2)_2H_2SO_4$	766.88
Sucrose (sugar)	$C_{12}H_{22}O_{11}$	342.30
Sugar, cane. (*See* Sucrose.)		
Sugar, milk. (*See* Lactose.)		
Sulfanilamide	$C_6H_8O_2N_2S$	172.20
Sulfapyridine	$C_{11}H_{11}N_3O_2S$	249.28
—— sodium	$C_{11}H_{10}N_3O_2SNa$	271.27
Sulfathiazole	$C_9H_9N_3O_2S_2$	255.31
Sulfobromophthalein	$C_{20}H_{10}Br_4O_{10}S_2$	794.06
—— sodium	$C_{20}H_8Br_4O_{10}S_2Na_2$	838.04
Sulfonethylmethane	$C_8H_{18}O_4S_2$	242.34
Sulfonmethane	$C_7H_{16}O_4S_2$	228.32
Sulfur	**S**	**32.06**
Sulfur dioxide	SO_2	64.06
—— trioxide	SO_3	80.06
Tantalum	**Ta**	**180.88**
Tellurium	**Te**	**127.61**
Terbium	**Tb**	**159.2**
Terebene	$C_{10}H_{16}$	136.23
Terpin hydrate	$C_{10}H_{18}(OH)_2.H_2O$	190.28
Tetracaine hydrochloride	$C_{15}H_{24}N_2O_2.HCl$	300.82
Tetrachlorobenzoquinone. (*See* Chloranil.)		
Tetrachloroethylene	C_2Cl_4	165.85
Tetraiodofluorescein. (*See* Iodeosin.)		
Tetraiodophenolphthalein sodium. (*See* Iodophthalein sodium.)		
Tetramethylthionine chloride. (*See* Methylthionine chloride.)		
Thallium	**Tl**	**204.39**
Theobromine	$C_7H_8N_4O_2$	180.17
—— sodium	$C_7H_7N_4O_2Na$	202.16
Theophylline	$C_7H_8N_4O_2.H_2O$	198.18
—— anhydrous	$C_7H_8N_4O_2$	180.17
Thiamine hydrochloride	$C_{12}H_{17}ClN_4OS.HCl$	337.27
Thiosinamine. (*See* Allyl-thiocarbamide.)		
Thorium	**Th**	**232.12**
Thorium nitrate, anhydrous	$Th(NO_3)_4$	480.15
Thulium	**Tm**	**169.4**
Thymol	$C_{10}H_{14}O$	150.21
—— iodide (dithymol-diiodide)	$(C_{10}H_{12}O)_2I_2$	550.23
Thyroxin	$C_{15}H_{11}O_4NI_4$	776.93
Tin	**Sn**	**118.70**
Titanium	**Ti**	**47.90**
Toluene (toluol)	$C_6H_5CH_3$	92.13

o-Toluidine	$C_6H_4CH_3NH_2$	107.15
Triacetin. (*See* Glyceryl triacetate.)		
Tribromoethanol	$C_2H_3Br_3O$	282.79
Trichloroethylene	C_2HCl_3	131.40
Trinitrophenol (picric acid)	$C_6H_3O_7N_3$	229.11
Trioxymethylene. (*See* paraformaldehyde.)		
Tryparsamide	$C_8H_{10}O_4N_2AsNa.\frac{1}{2}H_2O$	305.09
Tungsten	**W**	**183.92**
Uranium	**U**	**238.07**
Uranyl acetate (uranium acetate)	$UO_2(C_2H_3O_2)_2.2H_2O$	424.19
Urea (carbamide)	$(NH_2)_2CO$	60.06
Vanadium	**V**	**50.95**
Vanillin	$C_8H_8O_3$	152.14
Water	H_2O	18.02
Xenon	**Xe**	**131.3**
Xylene (xylol)	$C_6H_4(CH_3)_2$	106.16
Ytterbium (neoytterbium)	**Yb**	**173.04**
Yttrium	**Y**	**88.92**
Zinc	**Zn**	**65.38**
Zinc acetate	$Zn(C_2H_3O_2)_2.2H_2O$	219.50
—— chloride	$ZnCl_2$	136.29
—— iodide	ZnI_2	319.22
—— oxide	ZnO	81.38
—— phenolsulfonate (sulfocarbolate)	$Zn(C_6H_4.OH.SO_3)_2.8H_2O$	555.83
—— sulfate	$ZnSO_4.7H_2O$	287.55
—— —— anhydrous	$ZnSO_4$	161.44
—— sulfocarbolate. (*See* Zinc phenolsulfonate.)		
—— valerate (valerianate)	$Zn(C_5H_9O_2)_2.2H_2O$	303.66
Zirconium	**Zr**	**91.22**

Section III. THERMOMETRIC EQUIVALENTS

Centigrade to Fahrenheit Scales

$$\frac{9}{5}\,^{\circ}\text{C.} + 32 = {}^{\circ}\text{F.}$$

°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.
−20	−4.0	21	69.8	61	141.8	101	213.8	141	285.8
−19	−2.2	22	71.6	62	143.6	102	215.6	142	287.6
−18	−0.4	23	73.4	63	145.4	103	217.4	143	289.4
−17	1.4	24	75.2	64	147.2	104	219.2	144	291.2
−16	3.2	25	77.	65	149.	105	221.	145	293.
−15	5.	26	78.8	66	150.8	106	222.8	146	294.8
−14	6.8	27	80.6	67	152.6	107	224.6	147	296.6
−13	8.6	28	82.4	68	154.4	108	226.4	148	298.4
−12	10.4	29	84.2	69	156.2	109	228.2	149	300.2
−11	12.2	30	86.	70	158.	110	230.	150	302.
−10	14.	31	87.8	71	159.8	111	231.8	151	303.8
− 9	15.8	32	89.6	72	161.6	112	233.6	152	305.6
− 8	17.6	33	91.4	73	163.4	113	235.4	153	307.4
− 7	19.4	34	93.2	74	165.2	114	237.2	154	309.2
− 6	21.2	35	95.	75	167.	115	239.	155	311.
− 5	23.	36	96.8	76	168.8	116	240.8	156	312.8
− 4	24.8	37	98.6	77	170.6	117	242.6	157	314.6
− 3	26.6	38	100.4	78	172.4	118	244.4	158	316.4
− 2	28.4	39	102.2	79	174.2	119	246.2	159	318.2
− 1	30.2	40	104.	80	176.	120	248.	160	320.
0	32.	41	105.8	81	177.8	121	249.8	161	321.8
1	33.8	42	107.6	82	179.6	122	251.6	162	323.6
2	35.6	43	109.4	83	181.4	123	253.4	163	325.4
3	37.4	44	111.2	84	183.2	124	255.2	164	327.2
4	39.2	45	113.	85	185.	125	257.	165	329.
5	41.	46	114.8	86	186.8	126	258.8	166	330.8
6	42.8	47	116.6	87	188.6	127	260.6	167	332.6
7	44.6	48	118.4	88	190.4	128	262.4	168	334.4
8	46.4	49	120.2	89	192.2	129	264.2	169	336.2
9	48.2	50	122.	90	194.	130	266.	170	338.
10	50.	51	123.8	91	195.8	131	267.8	171	339.8
11	51.8	52	125.6	92	197.6	132	269.6	172	341.6
12	53.6	53	127.4	93	199.4	133	271.4	173	343.4
13	55.4	54	129.2	94	201.2	134	273.2	174	345.2
14	57.2	55	131.	95	203.	135	275.	175	347.
15	59.	56	132.8	96	204.8	136	276.8	176	348.8
16	60.8	57	134.6	97	206.6	137	278.6	177	350.6
17	62.6	58	136.4	98	208.4	138	280.4	178	352.4
18	64.4	59	138.2	99	210.2	139	282.2	179	354.2
19	66.2	60	140.	100	212.	140	284.	180	356.
20	68.								

THERMOMETRIC EQUIVALENTS—Continued

Fahrenheit to Centigrade Scales

$$(°F. - 32) \times \frac{5}{9} = °C.$$

°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.
0	−17.78	51	10.56	101	38.33	151	66.11	201	93.89
1	−17.22	52	11.11	102	38.89	152	66.67	202	94.44
2	−16.67	53	11.67	103	39.44	153	67.22	203	95.
3	−16.11	54	12.22	104	40.	154	67.78	204	95.56
4	−15.56	55	12.78	105	40.56	155	68.33	205	96.11
5	−15.	56	13.33	106	41.11	156	68.89	206	96.67
6	−14.44	57	13.89	107	41.67	157	69.44	207	97.22
7	−13.89	58	14.44	108	42.22	158	70.	208	97.78
8	−13.33	59	15.	109	42.78	159	70.56	209	98.33
9	−12.78	60	15.56	110	43.33	160	71.11	210	98.89
10	−12.22	61	16.11	111	43.89	161	71.67	211	99.44
11	−11.67	62	16.67	112	44.44	162	72.22	212	100.
12	−11.11	63	17.22	113	45.	163	72.78	213	100.56
13	−10.56	64	17.78	114	45.56	164	73.33	214	101.11
14	−10.	65	18.33	115	46.11	165	73.89	215	101.67
15	−9.44	66	18.89	116	46.67	166	74.44	216	102.22
16	−8.89	67	19.44	117	47.22	167	75.	217	102.78
17	−8.33	68	20.	118	47.78	168	75.56	218	103.33
18	−7.78	69	20.56	119	48.33	169	76.11	219	103.89
19	−7.22	70	21.11	120	48.89	170	76.67	220	104.44
20	−6.67	71	21.67	121	49.44	171	77.22	221	105.
21	−6.11	72	22.22	122	50.	172	77.78	222	105.56
22	−5.56	73	22.78	123	50.56	173	78.33	223	106.11
23	−5.	74	23.33	124	51.11	174	78.89	224	106.67
24	−4.44	75	23.89	125	51.67	175	79.44	225	107.22
25	−3.89	76	24.44	126	52.22	176	80.	226	107.78
26	−3.33	77	25.	127	52.78	177	80.56	227	108.33
27	−2.78	78	25.56	128	53.33	178	81.11	228	108.89
28	−2.22	79	26.11	129	53.89	179	81.67	229	109.44
29	−1.67	80	26.67	130	54.44	180	82.22	230	110.
30	−1.11	81	27.22	131	55.	181	82.78	231	110.56
31	−0.56	82	27.78	132	55.56	182	83.33	232	111.11
32	0.	83	28.33	133	56.11	183	83.89	233	111.67
33	0.56	84	28.89	134	56.67	184	84.44	234	112.22
34	1.11	85	29.44	135	57.22	185	85.	235	112.78
35	1.67	86	30.	136	57.78	186	85.56	236	113.33
36	2.22	87	30.56	137	58.33	187	86.11	237	113.89
37	2.78	88	31.11	138	58.89	188	86.67	238	114.44
38	3.33	89	31.67	139	59.44	189	87.22	239	115.
39	3.89	90	32.22	140	60.	190	87.78	240	115.56
40	4.44	91	32.78	141	60.56	191	88.33	241	116.11
41	5.	92	33.33	142	61.11	192	88.89	242	116.67
42	5.56	93	33.89	143	61.67	193	89.44	243	117.22
43	6.11	94	34.44	144	62.22	194	90.	244	117.78
44	6.67	95	35.	145	62.78	195	90.56	245	118.33
45	7.22	96	35.56	146	63.33	196	91.11	246	118.89
46	7.78	97	36.11	147	63.89	197	91.67	247	119.44
47	8.33	98	36.67	148	64.44	198	92.22	248	120.
48	8.89	99	37.22	149	65.	199	92.78	249	120.56
49	9.44	100	37.78	150	65.56	200	93.33	250	121.11
50	10.								

Section IV. ISOTONIC FACTORS

To calculate approximate strength of a simple isotonic solution:

Data

$-0.56°$ = freezing point of human blood.
$-0.80°$ = freezing point of lachrymal fluid.
$-1.86°$ = freezing point of molal solution of nonelectrolyte.
i = increase in freezing-point lowering, molal solution of electrolyte.

Approximate values (to be used when more nearly accurate values are not known):

Nonelectrolytes: 1.0	Substances yielding 3 ions: 2.6
Substances yielding 2 ions: 1.8	Substances yielding 4 ions: 3.4
2-ion metal sulfates: 1.4	Substances yielding 5 ions: 4.2

Proportions

$$\frac{1.86 \times i}{0.56} = \frac{\text{Molecular weight}}{x} \qquad \frac{1.86 \times i}{0.80} = \frac{\text{Molecular weight}}{y}$$

x = Gm. of substance per 1000 Gm. water if solution is to be isotonic with blood.

y = Gm. of substance per 1000 Gm. water if solution is to be isotonic with tears.

Examples

$$\frac{1.86 \times 1.85}{0.56} = \frac{58.45 \text{ (Gm.)}}{x \text{ (Gm.)}} \qquad \frac{1.86 \times 1.00}{0.80} = \frac{61.84 \text{ (Gm.)}}{y \text{ (Gm.)}}$$

x = 9.5 Gm. sodium chloride per 1000 Gm. water (officially taken as 0.90% w/v), solution isotonic with blood.

y = 26.5 Gm. boric acid per 1000 Gm. water (approximately 2.65% w/v), solution isotonic with tears.

To calculate isotonic factors:

Rule. The molecular weight of Substance A divided by the molecular weight of Substance B (after each has been multiplied by the i value of the other) yields the amount of Substance A represented (in tonic effect) by 1 weight unit of Substance B. This figure is the Substance A isotonic factor for Substance B.

Sodium chloride factor. Multiply 58.45 by the i value of the given substance and divide the result by the product of the molecular weight of the given substance multiplied by 1.8. Result equals grams of NaCl represented by each gram of the given substance, or the NaCl factor for the given substance.

Boric acid factor. Multiply 61.84 by the i value of the given substance and divide the result by the molecular weight of the given substance (theoretically multiplied by 1.00).

To calculate amount of epitonic agent required:

Multiply the number of grams per 100 cc. of each ingredient by its NaCl or H_3BO_3 factor; subtract the total amount of NaCl or H_3BO_3 represented from the amount that should be contained in each 100 cc. of a simple isotonic solution of the kind desired.

Table of Isotonic Factors
(After Bradley and Gustafson)

Substance	Isotonic factors	
	NaCl	H_3BO_3
Alum (ammonium) $.12H_2O$	0.24	0.46
Alum (potassium) $.12H_2O$	0.23	0.44
Argyrol (20% silver)	0.06	0.11
Atropine sulfate $.H_2O$	0.12	0.23
Borax. (*See* Sodium borate.)		
Boric acid	0.52	1.00
Butacaine sulfate	0.12	0.23
Butyn sulfate. (*See* Butacaine sulfate.)		
Calcium chloride $.2H_2O$	0.57	1.09
Camphor	0.21	0.41
Chloretone. (*See* Chlorobutanol.)		
Chlorobutanol	0.18	0.35
Cocaine hydrochloride	0.17	0.33
Cupric sulfate $.5H_2O$	0.18	0.35
Dextrose $.H_2O$	0.16	0.31
Dionin. (*See* Ethylmorphine hydrochloride.)		
Ephedrine hydrochloride	0.29	0.55
Ephedrine sulfate	0.20	0.38
Epinephrine hydrochloride	0.27	0.51
Eserine salicylate. (*See* Physostigmine salicylate.)		
Eserine sulfate. (*See* Physostigmine sulfate.)		
Ethylmorphine hydrochloride $.2H_2O$	0.15	0.29
Ethylhydrocuprein hydrochloride	0.16	0.30
Fluorescein sodium	0.22	0.43
Holocaine hydrochloride. (*See* Phenacaine hydrochloride.)		
Homatropine hydrobromide	0.16	0.31
Hyoscine hydrobromide. (*See* Scopolamine hydrobromide.)		
Hyoscine hydrochloride. (*See* Scopolamine hydrochloride.)		
Larocaine hydrochloride	0.19	0.35
Mercury bichloride	0.12	0.23
Mercury cyanide	0.13	0.24
Mercury oxycyanide	0.07	0.13
Metycaine hydrochloride	0.20	0.37
Morphine hydrochloride $.3H_2O$	0.16	0.30
Morphine sulfate $.5H_2O$	0.11	0.21

Table of Isotonic Factors—Continued
(After Bradley and Gustafson)

Substance	Isotonic factors	
	NaCl	H_3BO_3
Neo-synephrine hydrochloride	0.29	0.55
Novocain. (*See* Procaine hydrochloride.)		
Optochin. (*See* Ethylhydrocuprein hydrochloride.)		
Phenacaine hydrochloride .H_2O	0.17	0.32
Physostigmine salicylate	0.14	0.27
Physostigmine sulfate	0.13	0.25
Pilocarpine hydrochloride	0.24	0.45
Pilocarpine nitrate	0.22	0.41
Pontocaine hydrochloride. (*See* Tetracaine hydrochloride.)		
Potassium phosphate (monobasic)	0.43	0.82
Potassium chloride	0.78	1.49
Potassium nitrate	0.58	1.10
Procaine hydrochloride	0.21	0.41
Protargol (7.5% to 8.5% silver)	0.024	0.046
Scopolamine hydrobromide .$3H_2O$	0.13	0.25
Scopolamine hydrochloride .$2H_2O$	0.16	0.30
Silver nitrate*	.....	.....
Sodium bicarbonate	0.70	1.32
Sodium biphosphate (monobasic)	0.49	0.93
Sodium biphosphate .H_2O	0.42	0.81
Sodium borate .$10H_2O$	0.36	0.68
Sodium carbonate	0.80	1.52
Sodium carbonate .H_2O	0.68	1.30
Sodium chloride	1.00	1.90
Sodium citrate .$2H_2O$	0.38	0.71
Sodium iodide	0.39	0.74
Sodium nitrate	0.69	1.31
Sodium phosphate .$2H_2O$ (dibasic)	0.47	0.90
Sodium phosphate .$7H_2O$	0.31	0.60
Sodium phosphate .$12H_2O$	0.24	0.45
Sodium sulfite	0.67	1.28
Sulfadiazine sodium	0.21	0.41
Sulfathiazole sodium (sesquihydrate)	0.19	0.37
Tannic acid	0.10	0.19
Tetracaine hydrochloride	0.19	0.37
Tutocain hydrochloride	0.20	0.39
Zinc chloride	0.62	1.18
Zinc sulfate .$7H_2O$	0.16	0.30

* Sodium nitrate and potassium nitrate may act as epitonic agents in solutions of silver nitrate without causing precipitation. Each gram of silver nitrate has the tonic effect of 0.50 Gm. of sodium nitrate and of 0.60 Gm. of potassium nitrate. Each 100 cc. of solution isotonic with lachrymal fluid should contain the equivalent of 2.02 Gm. of sodium nitrate or of 2.42 Gm. of potassium nitrate.

APPENDIX III

DRUG LIST

ACACIA, *acacia,* U.S.P. (gum arabic)
A gum occurring in yellowish-white tears, fragments, or powder.
Solubility: Slowly in water (2); insoluble in alcohol. In dissolving the powder, add all of the water at once to avoid lumping.
Incompatibilities: Lead subacetate solution produces a precipitate with it. Alcohol, concentrated, gelatinizes the mucilage. Bismuth subnitrate in mixtures is caused to cake by it.
Action and Uses: Demulcent, adhesive but not emollient, suspending agent in mixtures, emulsifying agent. In a sterile 6 per cent solution for intravenous injection, it is used to combat shock and hemorrhage.
Preparations: Mucilage of acacia, *mucilago acaciae,* U.S.P. Acacia, 350 Gm., Benzoic acid 2 Gm., distilled water to make 1000 cc. This may be prepared extemporaneously by dissolving the benzoic acid in 400 cc. of distilled water, adding this solution to powdered or granular acacia, in a mortar, and triturating until the acacia is dissolved. Enough distilled water is then added to make the product measure 1000 cc.
Syrup of Acacia, *syrupus acaciae,* N.F. Acacia, 100 Gm., sodium benzoate, 1 Gm., Tr. vanilla, 5 cc., sucrose, 800 Gm., distilled water to make 1000 cc.
Evidence of Deterioration: Mold in the mucilage; unpleasant odor indicating decomposition.
Storage: In well-closed containers, in a cool place.

ACETANILID, *acetanilidum,* U.S.P.
A white, odorless, crystalline powder.
Solubility: Slightly in water (190); freely in alcohol (3.5), glycerin (5) and chloroform (4).
Incompatibilities: Spirit of ethyl nitrite is colored reddish-yellow by it. Chloral hydrate, phenol, thymol and resorcinol form pasty masses when triturated with it.
Action and Uses: Analgesic, antipyretic, used particularly for headache and neuralgic pains. It produces cyanosis in excessive doses, due to the formation of methemoglobin.
Dosage: 0.2 Gm. usually in tablets, capsules or papers.
Preparations: Compound powder of acetanilid, *pulvis acetanilidi compositus,* N.F. Acetanilid, 70 Gm., caffeine, 10 Gm., sodium bicarbonate, 20 Gm. Tablets of acetanilid, *tabellae acetanilidi,* N.F., 0.2 Gm.
Storage: In well-closed containers.

ACETARSONE, N.N.R.
A white powder.
Solubility: Slightly soluble in water and in alcohol.
Action and Uses: Amebicide.
Dosage: 0.25 Gm.
Storage: In well-closed containers.

ACETONE, *acetonum,* U.S.P. (dimethyl-ketone)
A colorless, inflammable, volatile liquid, with an ethereal odor and a pungent, sweet taste.
Caution: Keep it away from fire.
Solubility: Miscible with water, alcohol, chloroform, ether and with most oils.
Sp. Gr.: 0.790. Boils: 56° C.
Action and Uses: Solvent, menstruum for extraction of oleoresins, vehicle for external preparations, reagent.
Preparations: In surgical solution of merbromin, N.F.
Storage: In tight containers, remote from fire.

ACETOPHENETIDIN, *acetophenetidinum,* U.S.P. (acetphenetidin, phenacetin)
A white, odorless, crystalline powder.
Solubility: Very slightly in water (1300), in alcohol (15), and chloroform (15).
Incompatibilities: Chloral hydrate and phenol form pasty masses when triturated with it.

Action and Uses: Analgesic, antipyretic, used for relief of headache and neuralgic pains and in the treatment of mild fevers.
Dosage: 0.3 Gm. usually in capsules, papers or tablets.
Preparation: Acetophenetidin tablets, *tabellae acetophenetidini,* U.S.P. 0.3 Gm.
Tablets of acetophenetidin and phenyl salicylate, *tabellae acetophenetidini et phenylis salicylatis,* N.F. (phenacetin and salol tablets). 0.15 Gm. each of acetophenetidin and phenyl salicylate.
Storage: In well-closed containers.

ACETYLSALICYLIC ACID, *acidum acetylsalicylicum,* U.S.P. (aspirin)
A white, odorless, crystalline powder or fine, white crystals.
Solubility: Slightly in water (300); freely in alcohol (5) and in chloroform (17). In aqueous solutions of alkali hydroxides and carbonates it dissolves with decomposition. It dissolves in concentrated aqueous alkaline citrate solutions.
Incompatibilities: It is decomposed by alkalies and by potassium and sodium iodides. Water causes decomposition to salicylic and acetic acids.
Action and Uses: Analgesic, antipyretic, antirheumatic. Its chief use is for relief of headache and in acute rheumatic fever.
Dosage: 0.3 Gm., usually in tablets, capsules or papers.
Preparations: Compound paste of acetylsalicylic acid, *pasta acidi acetylsalicylici composita,* N.F. (dental anodyne paste). Eugenol, 2 cc., Peruvian balsam, 10 Gm., acetylsalicylic acid, 25 Gm., white wax, 10 Gm., wool fat to make 100 Gm.
Acetylsalicylic acid tablets, *tabellae acidi acetylsalicylici,* U.S.P. 0.3 Gm.
Storage: In well-closed containers.

ACONITE, *aconitum,* N.F. (monkshood, aconite root)
A tuberous root.
Action and Uses: Stimulates nerve endings when applied locally to mucous membranes and so it has been used as a counterirritant. Given internally it causes cardiac slowing. A very toxic drug not used in modern medicine.
Dosage: 60 mg.
Preparations: Fluidextract of aconite, *fluidextractum aconiti,* N.F. Dose: 0.06 cc.
Tincture of aconite, *tinctura aconiti,* N.F. Dose: 0.6 cc.
Storage: In well-closed containers.

ACRIFLAVINE, *acriflavina,* N.F., (acriflavine base, neutral acriflavine)
A brownish-red, odorless, granular powder.
Solubility: Soluble in water (3). Incompletely soluble in alcohol.
Incompatibilities: Incompatible with Dakin's Solution and other chlorine antiseptics, with mercuric chloride, and with phenol.
Action and Uses: Antiseptic.
Dosage: For application to wounds, solution 1–1000; for irrigation, solutions 1–500 to 1–10,000
Storage: In tight containers.

ACTIVATED CHARCOAL, *carbo activatus,* U.S.P.
A fine, black, odorless, tasteless, powdered charcoal, free from gritty matter, treated to increase its adsorptive power.
Note. When *Carbo Ligni* is prescribed, *Carbo Activatus* may be dispensed.
Incompatibilities: It adsorbs coloring matter and alkaloids from solutions.
Action and Uses: Adsorbent of gases and dissolved substances. Used internally against digestive disorders and vegetable poisons but of doubtful value. Locally employed as a deodorant for fetid ulcers, usually in the form of a poultice.
Dosage: 1 Gm.
Storage: In well-closed containers.

AGAR, *agar,* U.S.P. (agar-agar)
A mucilaginous substance extracted from certain seaweeds.
Solubility: Insoluble in cold water, but slowly soluble in hot water.
Action and Uses: Intestinal demulcent and lubricant. Used in chronic constipation or intestinal atony.
Dosage: 4 Gm.

ALCOHOL, *alcohol,* U.S.P. (ethyl alcohol, ethanol, *spiritus vini rectificatus)* C_2H_5OH.
A colorless, transparent, mobile, volatile liquid, having a slight, characteristic odor and a burning taste. It is inflammable. At 15.56°C., it contains not less

than 92.3 per cent by weight, corresponding to 94.9 per cent by volume, of C_2H_5OH.

Solubility: Miscible with water, with ether, with glycerin and with chloroform.

Sp. Gr.: 0.816. Boils: 78°C.

Action and Uses: Rubefacient, astringent, antiseptic.

Storage: In tight containers, remote from fire.

ALOE, *aloe,* U.S.P. (Aloes)

A dark-yellow, yellowish-brown, or olive-brown powder.

Solubility: Incompletely soluble in water and in alcohol.

Action and Uses: Cathartic.

Dosage: 0.25 Gm.

Evidence of Deterioration: A caked product.

Storage: In tight containers.

ALUM, *alumen,* U.S.P. (Ammonium alum) $AlNH_4(SO_4)_2 \cdot 12H_2O$; (potassium alum) $AlK(SO_4)_2 \cdot 12H_2O$.

Large, colorless crystals, crystalline fragments, or a white powder. It is odorless, and has a sweetish, strongly astringent taste.

Solubility: Ammonium alum is soluble in water (7). Potassium alum is soluble in water (7.5). Both forms are insoluble in alcohol, and freely but slowly soluble in glycerin.

Incompatibilities: Alkalies, borax, carbonates, and lime water cause precipitation in solutions of alum.

Action and Uses: Astringent, styptic, and hemostatic.

Preparations: Exsiccated alum, *alumen exsiccatum,* U.S.P. (dried alum, burnt alum).

Storage: In well-closed containers.

ALUMINUM ACETATE, *alumini acetas.*

A white powder, rarely available except in solution.

Solubility: Soluble in water.

Incompatibilities: Alkalies precipitate it from solution.

Action and Uses: Astringent, usually in lotions or ointments.

Preparations: Solution of aluminum acetate, *liquor alumini acetatis,* N.F. (Burow's solution). Dissolve 150 Gm. of lead acetate and 87 Gm. of aluminum sulfate, each separately, in 525 cc. of water. Pour the lead acetate solution into the aluminum sulfate solution with constant stirring and set the mixture aside for 24 hours. Separate 1000 cc. of the clear, supernatant liquid by decantation or filtration.

This solution is also prepared by mixing 15 cc. of glacial acetic acid with 545 cc. of solution of aluminum subacetate and enough water to make 1000 cc. Special tablets to be dissolved in water to make this solution are sometimes available.

Evidence of Deterioration: A white precipitate in the solution.

Storage: In tight containers.

ALUMINUM CHLORIDE, *alumini chloridum,* N.F.

A white, or yellowish-white, deliquescent, crystalline powder. It is nearly odorless, and has a sweetish, very astringent taste.

Solubility: Soluble in water (0.5), in alcohol (4), soluble in glycerin.

Action and Uses: Antiseptic and astringent. Used in 5 per cent to 25 per cent solution in hyperidrosis. When used for this purpose it may cause dermatitis.

Preparations: Solution of aluminum chloride, *liquor alumini chloridi,* N.F.

Prepared by dissolving 250 Gm. of aluminum chloride in sufficient distilled water to make 1000 cc.

Evidence of Deterioration: Moist lumps or powder.

Storage: In tight containers.

ALUMINUM HYDROXIDE GEL, *alumini hydroxidi gelatum,* U.S.P. (colloidal aluminum hydroxide)

A white, viscous suspension.

Solubility: Insoluble in water and in alcohol. This gel is readily miscible with water.

Action and Uses: Gastric antacid for oral use in the treatment of peptic ulcer and symptomatic hyperchlorhydria.

Dosage: 8 cc.

Preparations: Dried aluminum hydroxide gel, *gelatum alumini hydroxidi siccum,* U.S.P. Dose: 0.6 Gm.

Evidence of Deterioration: Excessive separation, usually due to freezing.

Storage: In well-closed containers, avoiding freezing temperatures.

AMARANTH: *amaranthum,* U.S.P. (F.D. and C. Red No. 2)
A dark red-brown powder.
Solubility: Soluble in water (15); very slightly soluble in alcohol.
Action and Uses: An agent used to produce shades of red in coloring pharmaceutical preparations.
Preparations: Solution of amaranth, *liquor amaranthi,* U.S.P. A 1 per cent solution of amaranth in distilled water.
Storage: In well-closed containers.

AMMONIA, STRONG SOLUTION, *liquor ammoniae fortis,* U.S.P. (stronger ammonia water)
A colorless, transparent liquid, having an exceedingly pungent, characteristic odor, and a very caustic and alkaline taste. It contains about 28 per cent of NH_3.
Caution: Strong solution of ammonia must not be tasted nor its vapor inhaled.
Sp. Gr.: 0.897.
Incompatibilities: It has the incompatibilities common to alkalies.
Action and Uses: A reagent.
Preparations: Diluted solution of ammonia, *liquor ammoniae dilutus,* U.S.P. (ammonia water, U.S.P. XI). Strong solution of ammonia, 398 cc., distilled water, sufficient to make 1000 cc. This solution contains about 10 per cent of NH_3.
Evidence of Deterioration: Reduction in strength, as determined by assay.
Storage: In tight containers, at a temperature not above 25° C.

AMMONIATED MERCURY, *hydrargyrum ammoniatum,* U.S.P. (white precipitate)
White, pulverulent pieces or white, amorphous powder. It is odorless, and is stable in air, but is affected by light.
Solubility: Insoluble in water and in alcohol.
Action and Uses: In ointment as a skin antiseptic and parasiticide.
Preparations: Ammoniated mercury ointment, *unguentum hydrargyri ammoniati,* U.S.P. (white precipitate ointment). Ammoniated mercury, 5 Gm., wool fat, 5 Gm., white ointment, 90 Gm. *Caution:* The application of this ointment should not be preceded or followed by the application of a preparation containing iodine in any form.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

AMMONIUM ACETATE, *ammonii acetas.*
Colorless, deliquescent crystals or white, crystalline masses, having a slight acetous odor.
Solubility: Soluble in water (less than 1), freely soluble in alcohol.
Action and Uses: Formerly used as a diuretic; occasionally used in poisoning by formaldehyde.
Dosage: 1 Gm.
Preparations: Solution of ammonium acetate, *liquor ammonii acetatis,* N.F. (spirit of mindererus) Prepared by dissolving 5 Gm. of ammonium carbonate in 100 cc. of diluted acetic acid. It should be freshly prepared. Dose: 15 cc.
Evidence of Deterioration: Partial liquefaction.
Storage: In tight containers.

AMMONIUM BROMIDE, *ammonii bromidum,* N. F.
Colorless crystals, or a white, crystalline powder, having no odor. It is somewhat hygroscopic.
Solubility: Soluble in water (1.3), in alcohol (12).
Incompatibilities: Soluble barbiturates are precipitated by it.
Action and Uses: Sedative.
Dosage: 1 Gm.
Preparations: Elixir of ammonium bromide, *elixir ammonii bromidi,* N.F.
Elixir of five bromides, *elixir bromidorum quinque,* N.F.
Elixir of three bromides, *elixir bromidorum trium,* N.F.
Syrup of the bromides, *syrupus bromidorum,* N.F.
Evidence of Deterioration: Slight yellowish discoloration or formation of a hard cake.
Storage: In tight containers.

AMMONIUM CARBONATE, *ammonii carbonas,* U.S.P. (sal volatile) A mixture of ammonium acid carbonate (NH_4HCO_3) and ammonium carbamate ($NH_2 \cdot COO \cdot NH_4$), yielding about 31.5 per cent NH_3.

White, hard, translucent masses, having a strong odor of ammonia and a sharp, ammoniacal taste.

Caution: For medicinal purposes, use only translucent pieces.

Solubility: Very slowly soluble in water (4). It is decomposed by hot water.

Incompatibilities: Acids and acid salts cause an evolution of carbon dioxide. Alkaloids are precipitated by it.

Action and Uses: Formerly used as an expectorant.

Preparations: Aromatic spirit of ammonia, *spiritus ammoniae aromaticus,* U.S.P. Dose: 2 cc. Action: Reflex cardiac and respiratory stimulant. Expectorant mixture, *mistura pectoralis,* N.F. (Stoke's expectorant).

Evidence of Deterioration: On exposure to air, it loses ammonia and carbon dioxide, becoming opaque and is finally converted into friable, porous lumps, or a white powder.

Storage: In tight containers at a temperature not above 30° C.

AMMONIUM CHLORIDE, *ammonii chloridum,* U.S.P. (sal ammoniac)

Colorless crystals or a white, fine or coarse, crystalline powder. It has a cool, saline taste and is somewhat hygroscopic.

Solubility: Soluble in water (2.6), in alcohol (100), and in glycerin (8).

Action and Uses: Liquefying expectorant and, in large doses, diuretic. It is also used to render the urine acid. Most useful to enhance the effects of mercurial diuretics.

Dosage: Expectorant, single dose. 0.3 Gm. Diuretic, daily dose, 3 to 6 Gm.

Preparations: Ammonium chloride capsules, *capsulae ammonii chloridi,* U.S.P., 1 Gm. Tablets of ammonium chloride, *tabellae ammonii chloridi,* N.F., 0.3 Gm. and 0.5 Gm., enteric coated.

Storage: In tight containers.

AMPHETAMINE SULFATE, N.N.R. (racemic amphetamine sulfate, racemic desoxynor—ephedrine)

A white, odorless powder.

Solubility: Freely soluble in water; slightly soluble in alcohol.

Action and Uses: Useful in the treatment of narcolepsy, in the treatment of certain depressive conditions, as an adjunct in the treatment of alcoholism and for facilitating roentgenographic studies of the gastro-intestinal tract. Its use is not advisable in the treatment of sleepiness and fatigue in normal individuals. Amphetamine bases is volatile and is used by inhalation to shrink the nasal mucous membrane.

Dosage: 5 to 10 mg., usually in tablets.

Storage: In well-closed containers.

AMYL NITRITE, *amylis nitris,* U.S.P.

A clear, yellowish liquid, having a peculiar, ethereal, fruity odor, and a pungent, aromatic taste. It is volatile even at low temperatures and is inflammable.

Solubility: Almost insoluble in water, but is miscible with alcohol and with ether.

Sp. Gr.: 0.87. Boils: 98°C., but volatilizes at much lower temperatures.

Action and Uses: Vasodilator and antispasmodic. Ordinarily used by inhaling the vapor from a crushed ampul ("pearl" or "perle"). Prevents and relieves attacks of angina pectoris.

Dosage: By inhalation, 0.2 cc.

Storage: In tight containers.

AMYTAL, Isoamylethylbarbituric acid, N.N.R.

A white, crystalline, odorless powder.

Solubility: Very slightly soluble in cold water; soluble in alcohol and in ether.

Incompatibilities: Acids decompose it.

Action and Uses: A sedative and hypnotic used in the control of insomnia and as a preliminary to surgical anesthesia. Its sodium salt is often given intravenously and is useful in the control of convulsive states from either poisoning or disease.

Dosage: 0.1 to 0.3 Gm., hypnotic; up to 0.6, before operation.

Storage: In tight containers.

AMYTAL SODIUM, N.N.R.

A white, friable, hygroscopic, granular powder, chemically related to barbital.

Solubility: Very soluble in water; freely soluble in alcohol.

Incompatibilities: Acids decompose it.

Action and Uses: Action much like barbital but less prolonged. Used as a hypnotic and sedative. Large doses, often given intravenously, are effective antidotes to

the convulsant poisons and are also used to combat convulsions due to disease.
Dosage: 0.2 Gm.
Storage: In tight containers.

ANTIANTHRAX SERUM, N.N.R.
A serum prepared by immunizing horses against virulent anthrax bacilli.
Action and Uses: Used in the treatment of anthrax.
Dosage: 50 cc. (minimum). Intramuscularly or intravenously.
Storage: In hermetic containers, at a temperature between 2° and 10° C.

ANTIDYSENTERIC SERUM, N.N.R.
The serum of horses immunized against the Shiga bacillus.
Action and Uses: Used in the treatment of bacillary dysentery, but it is less effective than the sulfonamides and so its use is declining.
Dosage: 20 to 100 cc., subcutaneously or intramuscularly.
Storage: In hermetic containers, at a temperature between 2° and 10° C.

ANTIMENINGOCOCCIC SERUM, *serum antimeningococcicum,* U.S.P. (antimeningococcus serum, meningitis serum)
Action and Uses: Formerly used in the treatment of meningitis, but far less effective than the sulfonamides.
Dosage: Parenteral, therapeutic, 20 cc.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

ANTIMONY AND POTASSIUM TARTRATE, *antimonii et potassii tartras,* U.S.P. (antimonyl potassium tartrate, tartar emetic)
Colorless, odorless, transparent crystals, or a white powder.
Caution: When antimony and potassium tartrate is to be dissolved in water, the water should first be heated to boiling.
Solubility: Soluble in water (12), in glycerin (15), insoluble in alcohol.
Incompatibilities: Alkalies and carbonates precipitate antimony and potassium tartrate.
Action and Uses: Emetic, expectorant, protozoacide. Used intravenously in schistosomiasis, kala-azar, and granuloma inguinale.
Dosage: As an emetic, 0.03 Gm. As an expectorant, 0.003 Gm. Intravenously, 0.04 Gm.
Preparations: Tincture of antimony, *tinctura antimonii,* N.F. (wine of antimony) Dissolve 4 Gm. antimony and potassium tartrate in 25 cc. of boiling distilled water, add 700 cc. of distilled water, 200 cc. of alcohol, 2 Gm. of caramel, 2 cc. of ethyl acetate, and sufficient distilled water to make 1000 cc.
Storage: In well-closed containers.

ANTIPNEUMOCOCCIC SERUM, *serum antipneumococcicum,* type specific, U.S.P. (antipneumococcus serum, pneumonia serum)
Caution: Type XIV antipneumococcic serum produced by immunization of the horse should not be administered to persons of blood group "A."
Action and Uses: Used in the treatment of lobar pneumonia, but less effective than the sulfonamides in most cases.
Dosage: Parenteral, therapeutic, from 20,000 to 100,000 units.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

ANTIPYRINE, *antipyrina,* U.S.P. (phenazone).
Colorless crystals or a white, crystalline powder. It is odorless, and has a slightly bitter taste.
Solubility: Soluble in water (less than 1), in alcohol (1.3), in chloroform (1), in ether (43).
Incompatibilities: It has so many incompatibilities that it should not ordinarily be prescribed in combination with other substances.
Action and Uses: Antipyretic, analgesic, sedative.
Dosage: 0.3 Gm.
Storage: In well-closed containers.

APOMORPHINE HYDROCHLORIDE, *apomorphinae hydrochloridum,* U.S.P.
Minute, white or grayish white, glistening crystals which acquire a greenish tint upon exposure to light and air.
Caution: Apomorphine hydrochloride must be rejected if it at once imparts an emerald green color to 100 parts of distilled water when shaken with it in a test tube.
Solubility: In water (50) and in alcohol (50).

Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Emetic, by hypodermic injection.
Dosage: Hypodermic, 5 mg. Oral, 1 mg.
Preparations: Tablets of apomorphine hydrochloride, *tabellae apomorphinae hydrochloridi,* N.F. Dose: 5 mg.
Evidence of Deterioration: Crystals having a greenish tint.
Storage: In small, tight, light-resistant vials, containing not more than 0.35 Gm.

ARECOLINE HYDROBROMIDE, *arecolinae hydrobromidum,* N.F.
A white, crystalline powder, or in the form of white crystals. It is odorless and has a bitter taste.
Solubility: Soluble in water (1), in alcohol (10).
Incompatibilities: Alkalies and iodine precipitate it from aqueous solutions.
Action and Uses: Anthelmintic, cathartic, miotic. Used principally in veterinary medicine.
Dosage: As an anthelmintic, 0.005 Gm. As a miotic, 0.5 per cent to 1 per cent aqueous solution.
Storage: In tight containers, protected from light.

ARSENIC TRIOXIDE, *arseni trioxidum,* U.S.P. (arsenious acid, arsenious oxide, white arsenic) As_2O_3.
A white, odorless powder, stable in air.
Caution: It is extremely poisonous.
Solubility: Slowly soluble in water, slightly soluble in alcohol and in ether, and freely soluble in glycerin.
Action and Uses: Formerly used as a hematinic and tonic; little used in modern medicine.
Dosage: 2 mg.
Preparations: Solution of arsenious acid, *liquor acidi arseniosi,* U.S.P. (Hydrochloric solution of arsenic, solution of arsenic chloride.)
Prepared by boiling 10 Gm. of arsenic trioxide with 50 cc. of diluted hydrochloric acid and 250 cc. of distilled water until solution results, and then adding sufficient distilled water to make 1000 cc. Dose: 0.2 cc. This solution is incompatible with carbonates and bicarbonates. Solution of potassium arsenite, *liquor potassii arsenitis,* U.S.P. (Fowler's Solution). Prepared by boiling 10 Gm. of arsenic trioxide with 7.6 Gm. of potassium bicarbonate and 100 cc. of distilled water until solution is effected, then adding 30 cc. of alcohol and sufficient distilled water to make 1000 cc. Dose: 0.2 cc. Alkaloids and salts of the heavy metals are precipitated by it.
Storage: In well-closed containers.

ARSPHENAMINE, *arsphenamina,* U.S.P.
A light yellow powder, odorless or having a slight odor, hygroscopic. It contains about 31 per cent of arsenic.
Caution: In the dry state or in solution, it is oxidized by exposure to the air, becoming darker and more toxic. Do not confuse with neoarsphenamine.
Solubility: Soluble in water, in alcohol, and in glycerin, but only very slightly soluble in chloroform and in ether.
Action and Uses: Used in the treatment of syphilis.
Dosage: Intravenous, 0.3 Gm. Prior to injection the solution must be alkalinized with 0.85 cc. of normal sodium hydroxide for each 0.1 Gm. of arsphenamine; and well diluted.
Evidence of Deterioration: Darkening on exposure to air.
Storage: In a cool place, preferably not above 10° C., in sealed containers of colorless glass, from which the air has been excluded either by the production of a vacuum or by displacement with a nonoxidizing gas.

ASAFETIDA, *asafoetida,* N.F.
An oleo-gum-resin having a strong, alliaceous odor.
Action and Uses: Formerly used as a carminative and in the treatment of neuroses when the action was probably mainly psychic.
Dosage: 0.4 Gm.
Preparations: Pills of asafetida, *pilulae asafoetidae,* N.F. Dose: 2 pills.
Tincture of asafetida, *tinctura asafoetidae,* N.F. Dose: 1 cc.
Storage: In tight containers.

ASCORBIC ACID, *acidum ascorbicum,* U.S.P. (vitamin C, cevitamic acid)
White or yellowish white, odorless crystals or powder.

Solubility: In water (3) and in alcohol (30); insoluble in chloroform, in ether and in benzene.
Incompatibilities: Alkaline solutions, oxygen. For solutions to be sterilized, use only water from which air has been removed.
Action and Uses: An essential constituent of the diet. Used in scurvy and in other conditions in which there is a deficiency of it in the diet or where there is interference with its absorption, even when the diet contains a normal amount.
Dosage: 50 mg. usually in tablets. In solution for parenteral use, ampuls, 100 mg. in 2 cc.
Preparations: Ascorbic acid tablets, *tabellae acidi ascorbici,* U.S.P. (vitamin C tablets). 25 mg., 50 mg., 100 mg.
Evidence of Deterioration: Discoloration (gray).
Storage: In tight containers.

ATROPINE SULFATE, *atropinae sulfas,* U.S.P.
Colorless crystals or a white, crystalline powder. It effloresces in dry air, and is affected by light.
Caution: It is extremely poisonous.
Solubility: Soluble in water (0.5), in alcohol (5), and in glycerin (2.5).
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Paralyzes the parasympathetic nerve endings. It is used especially as a mydriatic and cycloplegic, to suppress secretions, to quicken the heart, to regulate peristalsis, and to lessen bronchial spasm.
Dosage: 0.5 mg.
Preparations: Atropine sulfate tablets, *tabellae atropinae sulfatis,* U.S.P., 0.6 mg., 0.4 mg., 0.3 mg.
Storage: In tight, light-resistant containers.

BARBITAL SODIUM, *barbitalum sodicum,* U.S.P. (Soluble barbital, sodium diethylbarbiturate, soluble barbitone, sodium diethylmalonylurea.)
A white, odorless powder, having a bitter taste. It is stable in air.
Solubility: Soluble in water (5); slightly soluble in alcohol.
Incompatibilities: Acids decompose it, precipitating barbital.
Action and Uses: Widely used hypnotic and sedative.
Dosage: 0.3 Gm.
Preparations: Barbital sodium tablets, *tabellae barbitali sodici,* U.S.P. (soluble barbital tablets), 0.3 Gm.
Storage: In well-closed containers.

BARIUM SULFATE, *barii sulfas,* U.S.P.
A fine, white, odorless, tasteless, bulky powder.
Caution: When barium sulfate is prescribed, the title should always be written in full to avoid confusion with the poisonous barium sulfide or sulfite.
Solubility: Insoluble in all solvents.
Action and Uses: For Roentgen-ray examinations of the gastrointestinal tract.
Storage: In well-closed containers.

BELLADONNA, *belladonna,* U.S.P.
Leaves or roots.
Action and Uses: Used internally as an antispasmodic, and to suppress secretions and to quicken the heart; locally as a mild local anesthetic.
Preparations: Belladonna liniment, *linimentum belladonnae,* N.F. Camphor, 50 Gm., fluidextract of belladonna root, sufficient to make 1000 cc.
Belladonna ointment, *unguentum belladonnae,* U.S.P. Pilular extract of belladonna, 10 Gm., diluted alcohol, 5 cc., yellow ointment, 85 Gm.
Extract of belladonna, *extractum belladonnae,* U.S.P. Dose: 15 mg. Prepared from belladonna leaf. Both the pilular and powdered forms are official.
Fluidextract of belladonna leaf, *fluidextractum belladonnae folii,* N.F. Dose: 0.06 cc.
Fluidextract of belladonna root, *fluidextractum belladonnae radicis,* N.F. Dose: 0.05 cc.
Tincture of belladonna, *tinctura belladonnae,* U.S.P. Dose: 0.6 cc. Prepared from belladonna leaf.
Storage: In well-closed containers.

BENTONITE, *bentonitum,* U.S.P. A native, colloidal, hydrated aluminum silicate. A very fine, odorless, tasteless, and practically colorless powder, free from grit, or in small granules.

Solubility: It is insoluble in water, but swells to about eight times its volume when added to water, and produces an opalescent suspension or paste. It is insoluble in organic solvents and does not swell in these. Solution of calcium hydroxide decreases the viscosity of bentonite gels.

Action and Uses: It is pharmacologically inert. It is used as a suspending agent and thickener in pharmaceutical preparations. For these purposes it is ordinarily used in from 1 to 4 per cent of the volume of the finished preparation.

Preparations: Magma of bentonite, *magma bentoniti,* N.F. Sprinkle 50 Gm. of bentonite, in divided portions, upon 800 cc. of hot distilled water. Allow it to stand with occasional stirring for 24 hours; add sufficient distilled water to make 1000 cc., and mix thoroughly.

Storage: In well-closed containers.

BENZOIC ACID, *acidum benzoicum,* U.S.P.

Fine, white, nearly odorless crystals, somewhat volatile at moderately warm temperatures.

Solubility: Slightly in water (275), in alcohol (3), in chloroform (5), and in ether (3). Soluble in fixed and in volatile oils.

Action and Uses: Mild antiseptic, diuretic, fungicide; preservative in mucilage of acacia, cherry juice, etc.

Dosage: Rarely used by itself. An ingredient of camphorated tincture of opium.

Preparations: Ointment of benzoic and salicylic acids, *unguentum acidi benzoici et acidi salicylici,* N.F. (Whitfield's ointment). Benzoic acid, 12 Gm., salicylic acid, 6 Gm., wool fat, 5 Gm., white petrolatum to make 100 Gm.

Storage: In well-closed containers.

BENZOIN, *benzoinum,* U.S.P. (Sumatra benzoin, Siam benzoin)

Sumatra benzoin, reddish-brown or grayish-brown resinous masses or lumps of varying size. Siam benzoin, yellowish-brown to rusty-brown, pebble-like tears of variable size.

Solubility: Both varieties are incompletely soluble in alcohol; they are insoluble in water but form emulsions when their tinctures are mixed with aqueous fluids.

Action and Uses: Often used in steam inhalations. Used to protect the skin under adhesive strapping.

Preparations: Tincture of benzoin, *tinctura benzoini,* U.S.P., a 20 per cent tincture with alcohol as the menstruum, prepared by maceration.

Compound tincture of benzoin, *tinctura benzoini composita,* U.S.P. (Friar's Balsam). Benzoin, 100 Gm., aloe, 20 Gm., storax, 80 Gm., Tolu balsam, 40 Gm., alcohol, to make 1000 cc. Prepared by maceration.

Storage: In well-closed containers.

BENZYL BENZOATE, *benzylis benzoas.*

An oily liquid having a faint, aromatic odor and a sharp, burning taste.

Solubility: Insoluble in water or glycerin; miscible with alcohol, chloroform, ether, and oils.

Sp. Gr.: 1.114. Boils: 324°C. Melting point: 21°C.

Action and Uses: Antispasmodic. It is used externally in the treatment of scabies.

Dosage: 1 to 10 cc. of a 20 per cent alcoholic solution or emulsion.

Storage: In tight containers.

BILE SALTS.

A light cream-colored powder, consisting chiefly of sodium glycocholate and sodium taurocholate in the proportions in which they exist naturally.

Action and Uses: Bile salts are useful to promote the absorption of food fats and fat soluble vitamins when failure to absorb these constituents is due to insufficient bile in the intestinal tract.

Dosage: 0.06 to 0.2 Gm.

Preparations: Tablets, enteric coated.

Storage: In tight containers.

BISMUTH AND POTASSIUM TARTRATE, *Bismuthi et Potassii Tartras,* U.S.P. (potassium bismuth tartrate, potassium bismuthyl tartrate)

A granular, white, odorless powder, having a sweetish taste. It darkens on exposure to light.

Solubility: Soluble in water (2); insoluble in alcohol.

Incompatibilities: Acids decompose it.

Action and Uses: Antisyphilitic.

Dosage: Intramuscular, 0.1 Gm.

Preparations: Bismuth and potassium tartrate injection, *injectio bismuthi et potassii Tartratis,* U.S.P.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

BISMUTH SUBCARBONATE, *bismuthi subcarbonas,* U.S.P. (basic bismuth carbonate)
A white, or pale yellowish-white powder, without odor or taste.
Solubility: Insoluble in water and in alcohol.
Incompatibilities: Acids decompose it, liberating carbon dioxide.
Action and Uses: Protective for skin and mucous membranes. Used in diarrhea.
Dosage: 1 Gm.
Preparations: Tablets of bismuth subcarbonate, *tabellae bismuthi subcarbonatis,* N.F., 1 Gm.
Evidence of Deterioration: It may darken on long exposure to light.
Storage: In well-closed, light-resistant containers.

BISMUTH SUBNITRATE, *bismuthi subnitras,* U.S.P. (basic bismuth nitrate)
A white, very slightly hygroscopic powder.
Solubility: Practically insoluble in water and in alcohol.
Incompatibilities: In the presence of water, it slowly decomposes carbonates and bicarbonates with the evolution of carbon dioxide. Liquid mixtures containing bismuth subnitrate and sodium bicarbonate are frequently prescribed. In compounding these prescriptions, bismuth subnitrate should be replaced with an equal weight of bismuth subcarbonate.
Action and Uses: Protective, astringent, and antiseptic. It is used externally, but bismuth or nitrite poisoning may develop if it is applied over a large area.
Dosage: 1 Gm.
Preparations: Paste of bismuth, *pasta bismuthi,* N.F. (Beck's bismuth paste). Melt 5 Gm. of white wax, 5 Gm. of paraffin, and 60 Gm. of white petrolatum together, and sterilize the mixture. Cool and incorporate 30 Gm. of bismuth subnitrate under aseptic conditions.
Tablets of bismuth subnitrate, *tabellae bismuthi subnitratis,* N.F., 1 Gm.
Storage: In well-closed containers.

BISMUTH SUBSALICYLATE, *bismuthi subsalicylas,* U.S.P. (basic bismuth salicylate)
A white or nearly white, amorphous or microcrystalline, odorless powder. It is stable in air, but is affected by light.
Solubility: Practically insoluble in cold water.
Action and Uses: Antisyphilitic.
Dosage: Intramuscular, in oil, 0.1 Gm.
Preparation: Bismuth subsalicylate injection, *injectio bismuthi subsalicylatis,* U.S.P. Dose: 0.1 Gm.
Evidence of Deterioration: It may darken on long exposure to light.
Storage: In well-closed, light-resistant containers.

BLACK MUSTARD, *sinapis nigra,* U.S.P. (brown mustard)
Whole or ground ripe seeds.
Action and Uses: Irritant, rubefacient, vesicant, and emetic.
Dosage: Emetic, 10 Gm.
Preparations: Mustard plaster, *emplastrum sinapis,* U.S.P. (mustard paper)
Note. Before it is applied, mustard plaster should be thoroughly moistened with tepid water.
Storage: In well-closed containers.

BORIC ACID, *acidum boricum,* U.S.P. (boracic acid).
Colorless, odorless scales or crystals or a white powder; slightly unctuous to the touch.
Solubility: Slowly in water (18), in alcohol (18), in glycerin (4). Readily in hot water. The crystals are more readily soluble than the powder in water; the powder is more readily soluble than the crystals in alcohol.
Action and Uses: Mild antiseptic and mild astringent on mucous membranes. Poisonous if used internally.
Dosage: Aqueous solution, 2 to 5 percent (saturated) in conjunctivitis, cystitis, etc. Externally as a dusting powder. In mouth washes like antiseptic solution, N.F. In soluble antiseptic powders like compound powder of zinc sulfate, N.F.
Preparations: Solution of boric acid, *liquor acidi borici,* N.F. (saturated solution of boric acid). 5 percent boric acid in distilled water. The solution must be free from crystalline deposits.

Boric acid ointment, *unguentum acidi borici,* U.S.P. Boric acid, 10 Gm., wool fat, 5 Gm., white ointment to make 100 Gm.

Glycerite of boroglycerin, *glyceritum boroglycerini,* U.S.P. Add 310 Gm. of boric acid in portions to 460 Gm. of glycerin heated to 140° to 150° C. Continue the heat until the boric acid is dissolved and the solution weighs 500 Gm. Add 500 Gm. of glycerin, mix thoroughly and transfer it immediately to a tight container.

Storage: In well-closed containers.

BUTACAINE SULFATE, *butacainae sulfas,* U.S.P.

A white, odorless, crystalline powder. It produces numbness when placed upon the tongue.

Solubility: Slowly soluble in less than its own weight of water; very soluble in warm alcohol and in acetone.

Incompatibilities: Alkalies, carbonates, bicarbonates, and chlorides precipitate it.

Action and Uses: A local anesthetic acting through intact mucosa about as effectively as cocaine.

Dosage: Ordinarily used in 2 percent solution.

Storage: In tight, light-resistant containers.

CAFFEINE AND SODIUM BENZOATE, *caffeina et sodii benzoas,* U.S.P. (caffeine with sodium benzoate, caffeine sodio-benzoate.) A mixture containing approximately equal parts of caffeine and sodium benzoate.

A white, odorless powder, having a slightly bitter taste.

Solubility: Soluble in water (1.2), a portion of the caffeine usually separating on standing, and in alcohol (30).

Action and Uses: Diuretic and cardiac, respiratory, vasomotor, and cerebral stimulant.

Dosage: Oral or intramuscular, 0.5 Gm.

Preparations: Caffeine and sodium benzoate injection, *injectio caffeinae et sodii benzoatis,* U.S.P. Dose: 0.5 Gm.

Storage: In well-closed containers.

CALCIUM CHLORIDE, *calcii chloridum,* U.S.P.

White, hard, odorless fragments or granules. Deliquescent.

Solubility: Soluble in water (1.2), in alcohol (10).

Action and Uses: Blood calcium restorative, systemic acidifier. Used in acute phase of lead poisoning.

Dosage: Intravenous, 1 Gm.

Preparations: Isotonic solution of three chlorides, *liquor chloridorum trium isotonicus,* U.S.P. (Ringer's solution)

Ampuls of calcium chloride, *ampullae calcii chloridi,* N.F., 1 Gm.

Evidence of Deterioration: Deliquesced fragments or granules.

Storage: In tight containers.

CALCIUM GLUCONATE, *calcii gluconas,* U.S.P.

A white, crystalline or granular powder without odor or taste.

Solubility: Slowly soluble in water (30), insoluble in alcohol.

Action and Uses: It is used as a therapeutic source of calcium. (*See* calcium chloride.)

Dosage: Oral, 5 Gm.; intravenous, 1 Gm.

Preparations: Calcium gluconate injection, *injectio calcii gluconatis,* U.S.P. (calcium gluconate ampuls)

A sterile solution of calcium gluconate stabilized by the addition of calcium glycerosaccharate, calcium *d*-saccharate or other calcium salts. Dose: 1 Gm.

Storage: In well-closed containers.

CALCIUM HYDROXIDE, *calcii hydroxidum,* U.S.P.

A soft, white powder possessing an alkaline, slightly bitter taste.

Solubility: Soluble in water (630), soluble in glycerin and in syrup, insoluble in alcohol.

Incompatibilities: Acids dissolve it.

Action and Uses: Antacid. It is used in the form of the solution.

Preparations: Solution of calcium hydroxide, *liquor calcii hydroxidi,* U.S.P. (lime water, liquor calcis)

Add 3 Gm. of calcium hydroxide to 1000 cc. of cool distilled water and agitate repeatedly during one hour. Allow the excess of calcium hydroxide to settle. Decant and dispense only the clear, supernatant liquid. The undissolved portion of calcium hydroxide is not suitable for preparing additional quantities of solution of calcium hydroxide.

Storage: In well-filled, tight containers.

CALCIUM LACTATE, *calcii lactas,* U.S.P.

A white, almost odorless powder. It is somewhat efflorescent.

Solubility: Soluble in water (20); practically insoluble in alcohol.

Action and Uses: Used as a source of calcium.

Dosage: 1 Gm.

Preparations: Tablets of calcium lactate, *tabellae calcii lactatis,* N.F. 0.3 Gm.

Storage: In tight containers.

CALCIUM MANDELATE, *calcii mandelas,* U.S.P.

A white, odorless powder.

Solubility: Slightly soluble in cold water. Soluble in boiling water (80); insoluble in alcohol.

Action and Uses: Urinary antiseptic, effective only in acid urine.

Dosage: 4 Gm.

Storage: In well-closed containers.

CAMPHOR, *camphora,* U.S.P.

Colorless or white crystals, granules, or crystalline masses. It has a penetrating, characteristic odor, a pungent, aromatic taste, and is readily pulverizable in the presence of a little alcohol, ether or chloroform. It slowly volatilizes at ordinary temperatures.

Solubility: Soluble in water (800), in alcohol (1), in chloroform (0.5), in ether (1). It is freely soluble in carbon disulfide, in purified benzin, and in fixed and volatile oils.

Incompatibilities: An eutectic mixture is produced when it is triturated with menthol, phenol, thymol, chloral hydrate, salol, and other similar substances.

Action and Uses: Formerly used subcutaneously as a reflex circulatory and respiratory stimulant. Orally a carminative, a counterirritant when applied to skin.

Dosage: Oral or intramuscular, 0.2 Gm.

Preparations: Ampuls of camphor, *ampullae camphorae,* N.F. (Ampuls of camphor in oil), 0.2 Gm.

Camphor water, *aqua camphorae,* U.S.P. A saturated solution of camphor in distilled water. Dose: 10 cc.

Camphor liniment, *linimentum camphorae,* U.S.P. (camphorated oil). *Caution:* This preparation is not intended for hypodermic use. Place 800 Gm. of cottonseed oil in a dry container, heat it on a water bath, add 200 Gm. of camphor and stopper the container. Dissolve the camphor by agitation without further application of heat.

Spirit of camphor, *spiritus camphorae,* U.S.P. Dissolve 100 Gm. of camphor in enough alcohol to make 1000 cc. Dose: 1 cc.

Storage: In tight containers, avoiding exposure to excessive heat.

CANTHARIDES, *cantharis,* N.F. (Spanish flies, Russian flies)

Dried insects, yielding not less than 0.6 percent cantharidin.

Caution: Cantharides with an ammoniacal odor must not be used.

Action and Uses: Externally, a powerful irritant, rubefacient and vesicant. Internally, its use is dangerous and never justified.

Preparations: Cantharides cerate, *ceratum cantharidis,* N.F. (blistering cerate). Moisten 350 Gm. of cantharides with a mixture of 150 cc. of oil of turpentine and 25 cc. of glacial acetic acid, and set the mixture aside in a warm place for 48 hours. Melt together 175 Gm. of rosin, 175 Gm. of yellow wax and 200 Gm. of benzoinated lard, strain the mixture, add the macerated cantharides, and heat the mixture on a water bath until it is reduced to 1000 Gm. Discontinue the heating and stir the cerate until it becomes firm.

Plaster of cantharides, *emplastrum cantharidis,* N.F. It is prepared by spreading cantharides cerate evenly upon adhesive plaster, muslin, paper, or other suitable material.

Tincture of cantharides, *tinctura cantharidis,* N.F. Macerate 100 Gm. of finely powdered cantharides with 100 cc. of glacial acetic acid and 100 cc. of alcohol for four days. Transfer the mixture to a percolator and percolate slowly with alcohol until the mixture measures 1000 cc. Dose: 0.1 cc.

Evidence of Deterioration: Odor of ammonia.

Storage: In tight containers.

CAPSICUM, *capsicum,* N.F. (cayenne pepper)

A dried fruit.

Action and Uses: Carminative and rubefacient.

Dosage: 60 mg.

Preparations: Oleoresin of capsicum, *oleoresina capsici,* N.F. Dose: 15 mg.
Tincture of capsicum, *tinctura capsici,* N.F. Dose: 0.5 cc.
Ointment of capsicum, *unguentum capsici,* N.F. Oleoresin of capsicum, 5 Gm.; Paraffin, 10 Gm.; petrolatum, 85 Gm.
Storage: In well-closed containers.

CARBARSONE, *carbarsonum,* U.S.P.
A white, almost odorless powder, having a slightly acid taste.
Solubility: Slightly soluble in water and in alcohol.
Action and Uses: In intestinal amebiasis.
Dosage: 0.2 Gm.
Storage: In well-closed containers.

CARBON TETRACHLORIDE, *carbonei tetrachloridum,* U.S.P.
A clear, colorless, mobile liquid, having a characteristic, ethereal odor. It is not inflammable.
Solubility: Soluble in water (2000); miscible with alcohol, with chloroform, and with ether.
Sp. Gr.: 1.59
Action and Uses: As an anthelmintic for adults, single dose, 2.5 cc. Not to be repeated within 3 weeks.
Preparations: Carbon tetrachloride capsules, *capsulae carbonei tetrachloridi,* U.S.P.
Storage: In tight, light-resistant containers.

CARDAMOM SEED, *cardamomi semen,* U.S.P.
A dried, ripe seed.
Action and Uses: Used as a flavor and carminative.
Preparations: Compound tincture of cardamon, *tincture cardamomi composita,* U.S.P. Cardamom seed, 20 Gm., cinnamon, 25 Gm., caraway, 12 Gm., cochineal, 5 Gm., glycerin, 50 cc., diluted alcohol, sufficient to make 1000 cc.
Storage: In well-closed containers.

CASCARA SAGRADA, *cascara sagrada,* U.S.P.
A bark.
Action and Uses: Laxative.
Dosage: 1 Gm.
Preparations: Extract of cascara sagrada, *extractum cascarae sagradae,* U.S.P. Dose: 0.3 Gm.
Fluidextract of cascara sagrada, *fluidextractum cascarae sagradae,* U.S.P. Dose: 1 cc.
Aromatic fluidextract of cascara sagrada, *fluidextractum cascarae sagradae aromaticum,* U.S.P. Dose: 2 cc.
Storage: In well-closed containers.

CASTOR OIL, *oleum ricini,* U.S.P.
A viscous, pale yellow fixed oil.
Solubility: Soluble in alcohol (1).
Sp. Gr.: 0.955.
Action and Uses: Cathartic.
Dosage: 15 cc.
Preparations: Aromatic castor oil, oleum ricini aromaticum, N.F. 3 cc. of oil of cinnamon, 1 cc. of oil of clove, 0.5 Gm. of saccharin, 1 Gm. of vanillin, and 0.1 Gm. of coumarin are dissolved in 30 cc. of alcohol and the solution is mixed with enough castor oil to make 1000 cc.
Evidence of Deterioration: Rancidity.
Storage: In tight containers.

CERIUM OXALATE, *cerii oxalas,* N.F.
A fine, white, or slightly pink powder, without odor or taste, consisting of a mixture of the oxalates of cerium, neodymium, praseodymium, lanthanum, and other associated elements.
Solubility: Insoluble in all ordinary solvents.
Action and Uses: Formerly used as a gastric sedative; of doubtful value.
Dosage: 0.2 Gm.
Storage: In well-closed containers.

CHINIOFON, *chiniofonum,* U.S.P.
A canary yellow powder, having not more than a slight odor. It has a bitter taste, but leaves a distinctly sweetish after-taste.

Solubility: In water (25); insoluble in alcohol.
Action and Uses: Amebicide.
Dosage: 1 Gm.
Preparations: Chiniofon tablets, *tabellae chiniofoni,* U.S.P. Dose: 1 Gm.
Storage: In tight containers.

CHLORAL HYDRATE, *chloralis hydras,* U.S.P.
Colorless, transparent or white crystals, having an aromatic, penetrating, and slightly acrid odor, a slightly bitter, caustic taste. It slowly volatilizes when exposed to the air.
Solubility: Soluble in water (0.25), in alcohol (1.3). It is very soluble in olive oil and freely soluble in oil of turpentine.
Incompatibilities: Alkalies decompose it.
Action and Uses: Hypnotic.
Dosage: 0.6 Gm.
Storage: In tight containers.
Note. If prescribed with another salt in an alcoholic vehicle, the chloral concentrates in an upper layer and this may result in overdosage if it is poured off without shaking.

CHLORINATED LIME, *calx chlorinata,* (U.S.P. X)
A white or grayish white, granular powder, having the odor of chlorine. It contains not less than 30 percent of available chlorine.
Solubility: Incompletely soluble in water and in alcohol.
Incompatibilities: Acids decompose it, liberating chlorine.
Action and Uses: Reagent.
Evidence of Deterioration: A moist product.
Storage: In tight containers, in a cool place.

CHLOROAZODIN, *chloroazodinum,* U.S.P. (azochloramid)
Bright yellow needles or flakes.
Caution: Avoid heating it; it decomposes explosively at about 155° C.
Solubility: Very slightly soluble in water; slightly soluble in glycerin and glyceryl triacetate. Its solutions decompose on exposure to light.
Action and Uses: As a disinfectant for mucous membranes and for infected wounds and cavities.
Dosage: 1:3300 aqueous solutions and 1:2000 olive oil solutions are commonly used. The latter are prepared by dilution of the more stable official glyceryl triacetate solution.
Preparations: Solution of chloroazodin, *liquor chloroazodini,* U.S.P. Place 2.6 Gm. of chloroazodin in a dry flask and add enough glyceryl triacetate to make 1000 cc. Stir it until solution is complete, close the flask tightly and set it aside for at least 30 days, avoiding exposure to light. Filter it with the aid of suction and package it immediately in tight containers. Avoid contact with metal.
Evidence of Deterioration: The presence of free chlorine, caused by decomposition.
Storage: In tight, light-resistant containers, in a cool place.

CHLOROFORM, *chloroformum,* U.S.P.
A clear, colorless, mobile liquid, having a characteristic, ethereal odor, and a burning, sweet taste. It is not inflammable, but its heated vapor burns with a green flame. It is affected by light.
Caution: Care should be taken not to vaporize chloroform in the presence of a naked flame because of the production of noxious gases.
Sp. Gr.: 1.475. Boils: 61°C.
Solubility: Soluble in water (210). It is miscible with alcohol, ether, benzene, purified benzin, and with fixed and volatile oils.
Action and Uses: General inhalation anesthetic; antiseptic, analgesic, rubefacient when applied to skin.
Preparations: Chloroform water, *aqua chloroformi,* U.S.P. A saturated solution of chloroform in distilled water. In dispensing chloroform water from a stock bottle, only the supernatant liquid should be used. Dose, 15 cc. Chloroform liniment, *linimentum chloroformi,* U.S.P. A 30 percent solution of chloroform in camphor and soap liniment.
Spirit of chloroform, *spiritus chloroformi,* N.F. A 6 percent solution of chloroform in alcohol. Dose, 2 cc.
Storage: In tight, light-resistant containers, at a temperature which does not exceed 30° C.

CHOLERA VACCINE, N.N.R.
A vaccine prepared from killed cholera vibrios.

Action and Uses: Used in the prevention of cholera.
Dosage: Ordinarily administered in three doses containing 500 million, 1,000 million and 1,000 million killed cholera vibrios, respectively.
Storage: In hermetic containers, at a temperature between 2° and 10° C.

CHROMIUM TRIOXIDE, *chromii trioxidum,* U.S.P. (chromic anhydride, chromic acid) Dark, purplish-red crystals, often needle-like, or in flakes. It is deliquescent, and is destructive to animal and vegetable tissues.
Caution: It should not be brought into intimate contact with organic substances, as serious explosions are likely to result.
Solubility: Soluble in water (0.6).
Incompatibilities: Organic substances reduce it, often with explosive violence. It should never be dissolved in alcohol, glycerin, or other organic solvents.
Action and Uses: Caustic, astringent, germicide; used in 20 percent solution as a caustic; as an astringent or germicide, as in dentistry, in 4 to 7 percent solution.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

CHRYSAROBIN, *chrysarobinum,* U.S.P.
A brown to orange yellow, microcrystalline powder, consisting of neutral principles from Goa powder. It is odorless and tasteless.
Caution: It is very irritating to the eyes.
Solubility: Very slightly soluble in water. It is soluble in alcohol (400), in chloroform (15), and in ether (160).
Action and Uses: Antiparasitic; a powerful irritant to the skin, used chiefly in the treatment of psoriasis and trichophytosis.
Preparations: Chrysarobin ointment, *unguentum chrysarobini,* U.S.P. Triturate 6 Gm. of chrysarobin with 7 Gm. of chloroform, and gradually incorporate 86 Gm. of yellow ointment. The use of water instead of chloroform will facilitate the making of this preparation.
Storage: In well-closed containers.

CITRATED CAFFEINE, *caffeina citrata,* U.S.P. A mixture containing approximately equal parts of caffeine and citric acid.
A white, odorless powder, having a slightly bitter, acid taste.
Solubility: Soluble in warm water (4). On diluting the solution with an equal volume of water, a portion of the caffeine gradually separates, but redissolves on the further addition of water.
Action and Uses: Diuretic and cardiac, respiratory, vasomotor, and cerebral stimulant.
Dosage: 0.3 Gm.
Preparations: Tablets of citrated caffeine, *tabellae caffeinae citratae,* N.F., 0.3 Gm.
Storage: In well-closed containers.

CITRIC ACID, *acidum citricum,* U.S.P.
Colorless, odorless, translucent crystals.
Caution: Citric acid, in the form of opaque crystals or a white powder, should not be used for pharmaceutical purposes.
Solubility: Very soluble in water (0.5); freely in alcohol (2); soluble in ether (30).
Incompatibilities: Carbonates and bicarbonates are decomposed by it.
Action and Uses: As a component in the preparation of effervescing solutions and as a flavor.
Preparations: Syrup of citric acid, *syrupus acidi citrici,* U.S.P. Citric acid 10 Gm., distilled water 10 cc., tincture of lemon 10 cc., and syrup to make 1000 cc.
This preparation must not be dispensed if it has a terebinthinate odor or shows evidence of deterioration.
Evidence of Deterioration: A white coating on the crystals or a change to a white powder.
Storage: In tight containers.

COAL TAR, *pix carbonis,* N.F.
A nearly black, thick liquid.
Solubility: Slightly soluble in water; partially soluble in alcohol.
Action and Uses: Antiseptic, irritant. Commonly used in diseases of the skin.
Preparations: Solution of coal tar, *liquor picis carbonis,* N.F. (*liquor carbonis detergens*). 200 Gm. of coal tar and 100 Gm. of powdered quillaja are mixed with 700 cc. of alcohol and macerated for seven days. The mixture is then filtered and enough alcohol added through the filter to make 1000 cc.

Ointment of coal tar, *unguentum picis carbonis,* N.F. 5 Gm. of coal tar is incorporated with 95 Gm. of paste of zinc oxide.
Storage: In well-closed containers.

COCAINE HYDROCHLORIDE, *cocainae hydrochloridum,* U.S.P. (cocaine muriate)
Colorless crystals, or a white, crystalline powder.
Solubility: Soluble in water (0.5), in alcohol (3.5), in chloroform (15). It is soluble in glycerin and is insoluble in ether.
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Local anesthetic for eye, nose, and throat, local vasoconstrictor. Do not give internally. Danger of addiction.
Dosage: 0.5 to 10 percent solution applied locally in nose and throat, from 1 to 4 percent in eye.
Storage: In well-closed, light-resistant containers.

COD LIVER OIL, *oleum morrhuae,* U.S.P.
A pale yellow fixed oil containing vitamins A and D. It may contain flavoring substances.
Solubility: Soluble in ether and chloroform.
Sp. Gr.: 0.925.
Action and Uses: Employed for prevention and cure of rickets and to provide vitamins A and D where needed.
Dosage: 8 cc.
Preparations: Emulsion of cod liver oil, *emulsum olei morrhuae,* U.S.P. 500 cc. of cod liver oil is emulsified with 125 Gm. of finely powdered acacia, flavored with 100 cc. of syrup and 4 cc. of methyl salicylate, and enough water is added to make 1000 cc.
Evidence of Deterioration: Rancidity.
Storage: In tight containers.

CODEINE SULFATE, *codeinae sulfas,* U.S.P.
White crystals or a white crystalline powder. It effloresces in dry air and is affected by light.
Solubility: Soluble in water (30), in alcohol (1280).
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Analgesic, hypnotic and sedative.
Dosage: 0.030 Gm.
Preparations: Codeine sulfate tablets, *tabellae codeinae sulfatis,* U.S.P., 0.030 Gm.
Storage: In tight, light-resistant containers.

COLLODION, *collodium,* U.S.P.
A clear, or slightly opalescent, syrupy liquid. It is colorless, or slightly yellowish, and has the odor of ether. It is prepared by dissolving 40 Gm. of pyroxylin in a mixture of 750 cc. of ethyl oxide and 250 cc. of ethyl alcohol.
Caution: It is highly inflammable.
Sp. Gr.: 0.77.
Incompatibilities: Water precipitates the pyroxylin.
Action and Uses: Used to form a protective film and as a vehicle for external applications.
Preparations: Flexible collodion, *collodium flexile,* U.S.P. camphor, 20 Gm., castor oil, 30 Gm., collodion, sufficient to make 1000 Gm.
Evidence of Deterioration: A thickened product, caused by evaporation of the solvent.
Storage: In tight containers, at a temperature not above 30°C., remote from fire.

COTTONSEED OIL, *oleum gossypii seminis,* U.S.P.
A pale yellow fixed oil.
Solubility: Miscible with ether, chloroform, and purified benzin.
Sp. Gr.: 0.918.
Action and Uses: Frequently used in place of olive oil in external preparations.
Evidence of Deterioration: Rancidity.
Storage: In tight containers.

CREOSOTE, *creosotum,* N.F.
An almost colorless or yellowish, highly refractive oily liquid consisting of a mixture of phenols obtained from wood tar. It has a penetrating, smoky odor, and a burning, caustic taste.
Caution: It is destructive to animal tissues. Whenever creosote is indicated for internal medication, creosote from wood tar should be dispensed.

Action and Uses: Formerly used as an intestinal antiseptic.
Dosage: 0.25 cc.
Evidence of Deterioration: Darkening in color.
Storage: In tight, light-resistant containers.

CRESOL, *Cresol,* U.S.P.
A colorless, or yellowish to brownish-yellow, or pinkish, highly refractive liquid, becoming darker with age and on exposure to light. It has a phenol-like, sometimes empyreumatic odor.
Caution: It should be handled with care as it readily destroys tissue.
Solubility: Incompletely soluble in water (50); miscible with alcohol, ether, and glycerin; soluble in solutions of the fixed alkali hydroxides.
Action and Uses: Disinfectant and antiseptic.
Preparations: Saponated solution of cresol, *liquor cresolis saponatus,* U.S.P.
A 50 percent solution of cresol in soft soap.
Evidence of deterioration: A darkened product.
Storage: In tight, light-resistant containers.

CUPRIC SULFATE, *cupri sulfas,* U.S.P. (blue vitriol)
Deep blue, triclinic crystals, or blue, crystalline granules or powder. It has a nauseous, metallic taste and effloresces slowly in dry air.
Solubility: Soluble in water (3), in alcohol (500), in glycerin (3).
Action and Uses: Astringent, fungicide, reagent, and antidote for phosphorus poisoning. Formerly used as an emetic.
Dosage: 0.3 Gm.
Evidence of Deterioration: A white coating on the crystals, indicating efflorescence.
Storage: In tight containers.

DEXTROSE, *Dextrosum,* U.S.P. (*d*-Glucose)
Colorless crystals, or a white, crystalline or granular powder. It is odorless, and has a sweet taste.
Solubility: Soluble in water (1), in alcohol (60).
Action and Uses: Nutrient, antiketogenic and osmotherapeutic agent.
Preparations: Dextrose injection, *injectio dextrosi,* U.S.P. (dextrose ampuls)
Dextrose and sodium chloride injection, *injectio dextrosi et sodii chloridi,* U.S.P.
Storage: In well-closed containers.

DIETHYLSTILBESTROL, *diethylstilbestrol,* U.S.P. (stilbestrol)
A white, crystalline powder.
Solubility: Almost insoluble in water; soluble in alcohol.
Action and Uses: A synthetic estrogenic substance.
Dosage: 0.2 mg.
Preparations: Diethylstilbestrol capsules, *capsulae diethylstilbestrolis,* U.S.P. Dose: 0.2 mg.
Diethylstilbestrol injection, *injectio diethylstilbestrolis,* U.S.P.
Dose: Intramuscular, 0.2 mg.
Diethylstilbestrol tablets, *tabellae diethylstilbestrolis,* U.S.P.
Dose: 0.2 mg.
Storage: In tight, light-resistant containers.

DIGITALIS, *digitalis,* U.S.P.
Dried leaves.
Action and Uses: Cardiac stimulant and diuretic in cases of cardiac edema.
Dosage: 0.1 Gm.
Preparations: Digitalis capsules, *capsulae digitalis,* U.S.P.
Powdered digitalis, *digitalis pulverata,* U.S.P. Dose: 0.1 Gm.
Infusion of digitalis, *infusum digitalis,* N.F. A 1.5 percent infusion of digitalis, containing 10 percent alcohol, and flavored with 0.5 percent spirit of cinnamon.
Digitalis injection, *injectio digitalis,* U.S.P.
Digitalis tablets, *tabellae digitalis,* U.S.P., 0.05 Gm. and 0.1 Gm.
Tincture of digitalis, *tinctura digitalis,* U.S.P. Dose: 1 cc.
Storage: In water-proof, air-tight, light-resistant containers.

DIHYDROMORPHINONE HYDROCHLORIDE, *dihydromorphinoni hydrochloridum,* U.S.P.
A fine, white, odorless, crystalline powder. It is affected by light.
Solubility: Soluble in water (3); sparingly soluble in alcohol; nearly insoluble in ether.
Incompatibilities: Alkalies precipitate it.

Action and Uses: Sedative and analgesic. A morphine substitute. Danger of addiction.
Dosage: 2 mg.
Preparations: Dihydromorphinone hydrochloride tablets, *tabellae dihydromorphinoni hydrochloridi,* U.S.P., 2 mg.
Storage: In tight, light-resistant containers.

DIODOQUIN, N.N.R.
A double iodine compound of the hydroxyquinoline series, containing 63 percent iodine.
Action and Uses: Protozoacide and germicide. Used in amebiasis, trichomonas intestinalis infestations, and in bacillary dysentery.
Dosage: 0.21 Gm., 7 to 10 times daily.
Preparations: Tablets.
Storage: In tight containers.

DIODRAST, N.N.R.
A white, crystalline, odorless powder containing approximately 50 percent iodine.
Solubility: Slightly soluble in water.
Action and Uses: As a contrast medium in roentgen ray examinations of the urinary tract.
Dosage: Intravenous, 0.35 to 0.7 Gm.
Preparations: Ampuls, 10 and 20 cc.
Storage: In tight, light-resistant containers.

DIPHTHERIA ANTITOXIN, *antitoxinum diphthericum,* U.S.P. (purified antidiphtheric serum, concentrated diphtheria antitoxin, refined diphtheria antitoxin, antidiphtheric globulins)
A sterile aqueous solution of antitoxic substances obtained from the blood serum or plasma of a healthy animal which has been immunized against diphtheria toxin. It has a potency of not less than 500 antitoxic units per cc.
Action and Uses: Curative and prophylactic agent in diphtheria.
Dosage: By parenteral injection: therapeutic, 20,000 units; prophylactic, 1000 units.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit. It must be dispensed in the unopened glass container in which it was placed by the manufacturer.

DIPHTHERIA TOXIN FOR SCHICK TEST, *toxinum diphthericum diagnosticum,* U.S.P. (Schick test toxin)
Action and Uses: Used in the Schick test to determine susceptibility to diphtheria.
Dosage: Intracutaneous, 0.1 cc. of the dilution, representing 1/50 of the minimum lethal dose.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

DIPHTHERIA TOXOID, *toxoidum diphthericum,* U.S.P. (diphtheria anatoxin)
Action and Uses: Used to induce active immunity to diphtheria.
Dosage: Hypodermic, for active immunization, 1 cc., to be repeated at proper intervals until a negative Schick test is obtained.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

EMETINE HYDROCHLORIDE, *emetinae hydrochloridum,* U.S.P.
A white or very slightly yellowish, odorless, crystalline powder. It is affected by light.
Solubility: Freely soluble in water and in alcohol.
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Amebacide.
Dosage: Intramuscular, 60 mg.
Preparations: Emetine hydrochloride injection, *injectio emetinae hydrochloridi,* U.S.P. Dose: 60 mg.
Storage: In tight, light-resistant containers.

EPHEDRINE, *ephedrina,* U.S.P.
An unctuous, almost colorless solid, or white crystals. It gradually decomposes on exposure to light. The anhydrous form is hygroscopic.
Solubility: Soluble in water, alcohol, chloroform, and in ether. It is moderately and slowly soluble in liquid petrolatum, the solution becoming turbid if the ephedrine contains more than about 1 percent water.
Incompatibilities: Iodine is incompatible with it.
Action and Uses: Sympathicomimetic drug. Local vasoconstrictor, for nasal mucous membrane, ordinarily used in oily solution.

Dosage: For local application from 1 percent to 3 percent.

Preparations: Ephedrine spray, *nebula ephedrinae,* N.F. With the aid of heat, not exceeding 40° C., dissolve 10 Gm. of anhydrous ephedrine and 2 cc. of methyl salicylate in sufficient light liquid petrolatum to make 1000 cc.

Compound ephedrine spray, *nebula ephedrinae composita,* N.F. (compound ephedrine inhalant) Warm 10 Gm. of anhydrous ephedrine, 6 Gm. of camphor, 6 Gm. of menthol, and 3 cc. of oil of thyme on a water bath at 40° C. until a uniform liquid is obtained, then add enough light liquid petrolatum to make 1000 cc.

Storage: In tight, light-resistant containers, in a cold place.

EPHEDRINE SULFATE, *ephedrinae sulfas,* U.S.P.

White, odorless crystals or powder.

Solubility: Freely soluble in water and in hot alcohol; not readily soluble in cold alcohol; insoluble in oils.

Incompatibilities: Iodine causes precipitation from solution.

Action and Uses: Similar to ephedrine. Locally as a nasal vasoconstrictor; orally to prevent or relieve mild asthmatic attacks.

Dosage: 25 mg. in capsules or tablets; 1 percent in a jelly; 1 to 3 percent in aqueous solution for spray; 0.4 percent in syrup.

Preparations: Ampuls of ephedrine sulfate, *ampullae ephedrinae sulfatis,* N.F. 50 mg.

Jelly of ephedrine sulfate, *gelatum ephedrinae sulfatis,* N.F. Ephedrine sulfate, 10 Gm., tragacanth, 10 Gm., methyl salicylate, 0.1 cc., eucalyptol, 1 cc., oil of dwarf pine needles, 0.1 cc., glycerin, 150 Gm., distilled water to make 1000 Gm. Sodium phosphate, 1.6 Gm., may be added as a stabilizer.

Solution of ephedrine sulfate, *liquor ephedrinae sulfatis,* N.F. Ephedrine sulfate, 30 Gm., chlorobutanol, 5 Gm., sodium chloride, 3.6 Gm., distilled water to make 1000 cc.

Syrup of ephedrine sulfate, *syrupus ephedrinae sulfatis,* N.F. Ephedrine sulfate, 4 Gm., distilled water, 20 cc., alcohol, 20 cc., syrup of cherry to make 1000 cc.

Tablets of ephedrine sulfate, *tabellae ephedrinae sulfatis,* U.S.P. 25 mg.

Storage: In well-closed, light-resistant containers.

EPINEPHRINE, *epinephrina,* U.S.P.

A white or light brownish, microcrystalline, odorless powder, gradually darkening on exposure to air. It is affected by light.

Solubility: Very slightly soluble in water and in alcohol.

Action and Uses: Most powerful sympathicomimetic drug. Vasoconstrictor. It is usually used in the form of the hydrochloride to relieve asthma and other forms of allergic attacks, to raise blood pressure, for cardiac stimulation.

Dosage: Hypodermic, 0.5 mg., inactive when taken by mouth.

Preparations: Epinephrine hydrochloride injection, *injectio epinephrinae hydrochloridi,* U.S.P. A 1:1000 solution of epinephrine hydrochloride in water for injection. Dose: 1 cc.

Solution of epinephrine hydrochloride, *liquor epinephrinae hydrochloridi,* U.S.P. A 1:1000 solution of epinephrine hydrochloride in distilled water.

Dose: 1 cc.

Epinephrine hydrochloride spray, *nebula epinephrinae hydrochloridi,* U.S.P. A 1:100 solution of epinephrine hydrochloride in distilled water. Caution: The 1:100 solution is not for hypodermic use.

Evidence of Deterioration: A darkened product.

Storage: In tight, light-resistant containers.

ERGONOVINE MALEATE, *ergonovinae maleas,* U.S.P.

A white or faintly yellow, odorless, microcrystalline powder. It is affected by light.

Solubility: Soluble in water (36) and in alcohol (120).

Action and Uses: To contract the uterus, and to check post-partum hemorrhage.

Dosage: 0.5 mg.

Preparations: Ergonovine maleate tablets, *tabellae ergonovinae maleatis,* U.S.P.

Ergonovine maleate injection, *injectio ergonovinae maleatis,* U.S.P., intravenous or intramuscular, 0.2 mg.

Storage: In tight, light-resistant containers.

ERGOT, *ergota,* U.S.P.

The dried, purplish-brown or nearly black sclerotium developed on rye plants.

Action and Uses: Causes powerful tonic, sometimes tetanic, contraction of the uterus. Used to check post-partum hemorrhage by contracting the uterus.

Dosage: 2 Gm., in the form of the fluidextract.

Preparations: Fluidextract of ergot, *fluidextractum ergotae,* U.S.P.
Dosage: 2 cc.
Storage: In tight containers.

ETHER, *aether,* U.S.P (sulfuric ether, ethyl ether, diethyl ether)
A transparent, colorless, mobile liquid having a characteristic odor and a burning, sweetish taste.
Caution: Ether to be used for anesthesia must be preserved in tight containers of not more than 3 Kg. capacity and is not to be used for anesthesia if it has been removed from the original container longer than 24 hours. Highly volatile and very inflammable.
Solubility: Soluble in water (12). Miscible with alcohol, benzene, chloroform, purified benzin and with fixed and volatile oils.
Sp. Gr.: 0.715. Boils: 35° C.
Action and Uses: General inhalation anesthetic; its volatility makes it difficult to employ in the tropics. Its preparations have been used as carminatives.
Dosage: 1 cc.
Preparations: Spirit of ether, *spiritus aetheris,* N.F. (Hoffmann's drops).
Prepared by mixing 325 cc. of ethyl oxide with sufficient alcohol to make 1000 cc. Dose: 4 cc.
Compound spirit of ether, *spiritus aetheris compositus,* N.F. (Hoffmann's anodyne). Prepared by mixing 325 cc. of ethyl oxide with 650 cc. of alcohol and 25 cc. of ethereal oil.
Dose: 4 cc.
Evidence of Deterioration: It is slowly oxidized by the action of air, moisture, and light with the formation of peroxides. The deterioration can be demonstrated only by means of chemical tests.
Storage: In partly-filled, tight, light-resistant containers, holding not more than 3 Kg., remote from fire.

ETHYL CHLORIDE, *aethylis chloridum,* U.S.P. (kelene)
At low temperatures or under increased pressure, it is a colorless, mobile, very volatile liquid with a characteristic, ethereal odor, and a burning taste.
Caution: As the vapor is very inflammable, it must not be used near a flame.
Solubility: Slightly soluble in water; freely soluble in alcohol and ether.
Sp. Gr.: 0.921. Boils: 12°–13° C.
Action and Uses: Local anesthetic for minor operations, in the form of a spray for refrigeration. It has also been used by inhalation as a general anesthetic in short operations.
Storage: In tight containers, preferably fitted with a valve, remote from fire.

ETHYL NITRITE, SPIRIT, *spiritus aethylis nitritis,* N.F. (sweet spirit of nitre, spirit of nitrous ether)
A clear, mobile liquid with a pale yellow or faintly greenish yellow tint. It has a fragrant, ethereal, pungent odor and a sharp, burning taste. It is volatile and inflammable, and rapidly decomposes on exposure to light and air. It contains about 4 percent ethyl nitrite.
Sp. Gr.: 0.82.
Incompatibilities: Acids decompose it.
Action and Uses: Formerly employed as a weak diuretic and diaphoretic.
Dosage: 2 cc.
Evidence of Deterioration: Loss of color.
Storage: In small, well-filled tight containers, in a cold, dark place, remote from fire.

ETHYLMORPHINE HYDROCHLORIDE, *aethylmorphinae hydrochloridum,* U.S.P. (dionin)
A white, or faintly yellow, odorless, microcrystalline powder.
Solubility: Soluble in water (10), in alcohol (25), slightly in ether and in chloroform.
Incompatibilities: Alkalies and iodine cause precipitation in solutions of ethylmorphine hydrochloride.
Action and Uses: A drug of the morphine series, preferred over the others for use in the eye.
Dosage: 0.015 Gm. In solution (0.5 to 10 percent) for use in the eye.
Storage: In well-closed containers.

EUCALYPTOL, *eucalyptol,* U.S.P. (cineol)
A colorless liquid with a characteristic odor and a pungent, cooling taste.
Action and Uses: Employed as a local stimulant and antiseptic. It is a constituent of inhalants and sprays.

Dosage: 0.3 cc.
Preparations: Ingredient of antiseptic solution N.F., compound powder of zinc sulfate, alkaline aromatic solution, jelly of ephedrine sulfate.
Storage: In tight containers.

EUGENOL, *eugenol,* U.S.P.
A nearly colorless liquid with the aromatic odor of cloves.
Solubility: Slightly in water; readily miscible with alcohol, with chloroform, with ether and with fixed oils. Soluble in 70 percent alcohol (2).
Sp. Gr.: 1.064 to 1.070.
Action and Uses: Externally, a rubefacient and counterirritant and to some extent a local anesthetic; internally, a carminative. Employed in dental cements as an excipient.
Dosage: 0.1 cc.
Preparations: Cement of zinc compounds and eugenol, *caementum zinci compositionum et eugenolis,* N.F. (zinc-eugenol cement). The liquid portion is a mixture of 85 cc. eugenol and 15 cc. cottonseed oil.
Evidence of Deterioration: Darkening and thickening.
Storage: In tight, light-resistant containers.

FERRIC CHLORIDE, *ferri chloridum*
Brownish-yellow, very deliquescent, crystalline masses or lumps.
Incompatibilities: Tannins react to form a black product. In neutral or alkaline solutions a precipitate is formed.
Action and Uses: Astringent. Formerly used in the form of the tincture in gargles.
Preparations: Solution of ferric chloride, *liquor ferri chloridi,* N.F. (solution of iron perchloride). It contains about 10.5 percent Fe. and about 4 percent hydrochloric acid.
Tincture of ferric chloride, *tinctura ferri chloridi, N.F.* (tincture of iron). A dilution of solution of ferric chloride, 35 cc., with alcohol to make 100 cc.
Evidence of Deterioration: Deliquescence of crystals. Precipitation in solution or in the tincture.
Storage: In tight, light-resistant containers.

FERROUS IODIDE, *ferri iodidum.*
Very deliquescent crystals, rarely available.
Incompatibilities: Soluble hydroxides, carbonates and bicarbonates react with it causing precipitation.
Action and Uses: Formerly used as a hematinic and for iodide action.
Preparations: Syrup of ferrous iodide, *syrupus ferri iodidi,* N.F. Place 20 Gm. of iron, 60 Gm. of iodine, and 200 cc. of distilled water in a flask and shake the mixture occasionally until the reaction is complete. Heat it to boiling and dissolve 100 Gm. of sucrose in the hot liquid. Filter into a flask containing 750 Gm. of sucrose, rinsing the flask containing the iron with 240 cc. of hot distilled water and pour the rinsings on the filter. Agitate the filtrate until the sucrose is dissolved, then add 1.3 Gm. of citric acid and enough distilled water to make 1000 cc. Dose: 1 cc.
Evidence of Deterioration: Discoloration due to oxidation.

FERROUS SULFATE, *ferri sulfas,* U.S.P. (iron sulfate)
Pale bluish-green crystals or granules.
Solubility: Soluble in water (1.5); insoluble in alcohol.
Incompatibilities: Soluble hydroxides, carbonates and bicarbonates react to cause precipitation.
Action and Uses: Hematinic.
Dosage: 0.3 Gm.
Preparations: Exsiccated ferrous sulfate, *ferri sulfas exsiccatus,* U.S.P. (Dried ferrous sulfate). Contains 80 percent anhydrous ferrous sulfate. Ferrous sulfate tablets, *tabellae ferri sulfatis,* U.S.P.
Evidence of Deterioration: Efflorescence, discoloration from oxidation.
Storage: In tight containers.

FLUORESCEIN SODIUM, *fluoresceinum sodicum,* U.S.P.
An orange-red, odorless powder.
Solubility: Freely in water; sparingly in alcohol.
Action and Uses: Diagnostic for corneal lesions and foreign bodies in the eye.
Dosage: 2 Gm., with 3 Gm. sodium bicarbonate in water to make 100 cc., for ophthalmologic use.
Storage: In well-closed containers.

FORMALDEHYDE SOLUTION, *liquor formaldehydi,* U.S.P. (formalin)
A clear, colorless or nearly colorless liquid, having a pungent odor. On long standing, especially in the cold, the solution sometimes becomes cloudy, due to the separation of paraformaldehyde. It contains not less than 37 percent of formaldehyde.
Solubility: Miscible with water and with alcohol.
Incompatibilities: Incompatible with alkalies, tannin, gelatin, albumin, and salts of the heavy metals.
Action and Uses: A powerful germicide for sterilizing inanimate things, too irritant to be used on the skin or in wounds.
Evidence of Deterioration: A cloudy product.
Storage: In tight containers, at a temperature not below 25° C.

FUADIN SOLUTION, N.N.R. (stibophen)
A colorless, odorless aqueous solution containing 6.3 percent of an organic antimony compound.
Action and Uses: In the treatment of granuloma venereum and of schistosomiasis.
Dosage: Intramuscularly, first day, 1.5 cc.; second day, 3.5 cc.; and on the third, fifth, seventh, ninth, eleventh, thirteenth, and fifteenth days, 5 cc.
Storage: In tight, light-resistant containers.

GAS GANGRENE ANTITOXIN, N.N.R.
An antitoxic serum prepared by immunizing horses with the toxins *Clostridium perfringens* (*welchii*) and *Clostridium septicum* (*Vibrion septique*).
Action and Uses: Used in the prevention and treatment of gas gangrene.
Dosage: Therapeutic, 10,000 to 40,000 units each of *Cl. perfringens* and *Cl. septicum,* given intramuscularly or intravenously.
Storage: In hermetic containers, at a temperature between 2° and 10° C.

GENTIAN, *Gentiana,* U.S.P.
Yellowish-brown, usually powdered, roots and rhizomes.
Incompatibilities: Iron compounds cause a darkening of the tincture and elixir.
Actions and Uses: A simple bitter. Formerly used to stimulate appetite.
Dosage: 1 Gm. usually in form of the tincture or the elixir.
Preparations: Elixir of gentian, *elixir gentianae,* N.F.
Elixir of gentian and iron, *elixir gentianae et ferri,* N.F.
Glycerinated elixir of gentian, *elixir gentianae glycerinatum,* N.F.
Fluidextract of gentian, *fluidextractum gentianae,* N.F.
Compound infusion of gentian, *infusum gentianae compositum,* N.F.
Compound tincture of gentian, *tinctura gentianae composita,* U.S.P.
Gentian, 100 Gm., bitter orange peel, 40 Gm., cardamom seed, 10 Gm., extracted with a menstruum of alcohol, 500 cc., glycerin 100 cc., and water 400 cc. The extraction is completed with diluted alcohol.

GINGER, *zingiber,* U.S.P.
A dried rhizome.
Action and Uses: Flavor, carminative and gastrointestinal stimulant.
Large doses are very irritating.
Dosage: 0.6 Gm.
Preparations: Fluidextract of ginger, *fluidextractum zingiberis,* U.S.P.
Dose: 0.6 cc.
Oleoresin of ginger, *oleoresina zingiberis,* N.F. Dose: 30 mg.
Syrup of ginger, *syrupus zingiberis,* N.F. Mix 30 cc. of fluidextract of ginger with 20 cc. of alcohol, 10 Gm. of magnesium carbonate, and 60 Gm. of sucrose. Add 430 cc. of distilled water, filter, and dissolve 760 Gm. of sucrose in the clear filtrate with the aid of gentle heat. Dose: 10 cc.
Storage: In well-closed containers.

GLACIAL ACETIC ACID, *acidum aceticum glaciale,* U.S.P.
A colorless liquid with a pungent odor.
Caution: It will produce burns on the skin.
Solubility: Miscible with water, alcohol and glycerin.
Congeals: 15.6° C. On solidification it expands.
Incompatibilities: Carbonates and bicarbonates are decomposed by it.
Action and Uses: Caustic and escharotic. Solvent, in extraction of cantharides. Diluted, it is rubefacient and is used in liniments and lotions. Used as a reagent.
Preparations: Acetic acid, *acidum aceticum,* U.S.P. A 36 percent acid prepared by dilution with distilled water.

Diluted acetic acid, *acidum aceticum dilutum,* N.F. A 6 percent acid prepared by dilution with distilled water.

Storage: In well-closed containers, at a temperature above 16° C.

GLYCERIN, *glycerinum,* U.S.P. (glycerol)

A colorless, practically odorless, thick, hygroscopic liquid.

Caution: Avoid heating it above 145° C.

Solubility: Miscible with water and with alcohol; insoluble in chloroform, in ether and in fixed and volatile oils. Before adding salts like magnesium sulfate to it to be dissolved, it should be warmed.

Sp. Gr.: 1.25

Action and Uses: Solvent, demulcent and emollient, and preservative. Irritant when not diluted, and employed in enemas and in suppositories as a prompt evacuant.

Preparations: Glycerin suppositories, *suppositoria glycerini,* U.S.P. glycerin, 92 Gm., sodium stearate, 8 Gm., distilled water, 5 Gm., to make 30 adult or 50 infant rectal suppositories.

Storage: In tight containers.

GLYCERYL TRIACETATE, *glycerylis triacetas,* U.S.P. (triacetin)

A colorless, somewhat oily liquid.

Solubility: Soluble in water, in alcohol and in ether.

Sp. Gr.: 1.155

Action and Uses: As a solvent, particularly for chloroazodin.

Storage: In tight containers, avoiding contact with metals.

GLYCYRRHIZA, *glycyrrhiza,* U.S.P. (licorice root)

Rhizomes and roots yielding a yellow and sweet wood.

Incompatibilities: Acids destroy the sweet taste of its preparations.

Action and Uses: Used to disguise the taste of drugs and as a demulcent.

Dosage: 2 Gm.

Preparations: Extract of glycyrrhiza, *extractum glycyrrhizae,* U.S.P. The commercial, partially soluble extract in masses or in powder form.

Fluidextract of glycyrrhiza, *fluidextractum glycyrrhizae,* U.S.P.

Syrup of glycyrrhiza, *syrupus glycyrrhizae,* U.S.P. To 250 cc. of fluidextract of glycyrrhiza, 0.05 cc. of oil of fennel and 0.5 cc. of oil of anise are added and then enough syrup to make 1000 cc.

Compound mixture of opium and glycyrrhiza, *mistura opii et glycyrrhizae composita,* N.F. (brown mixture, compound licorice mixture). Dilute 120 cc. of fluidextract of glycyrrhiza with 120 cc. of glycerin and 500 cc. of distilled water, add 0.24 Gm. of antimony and potassium tartrate which has been dissolved in 12 cc. of hot distilled water, then add 120 cc. of camphorated tincture of opium, 30 cc. of spirit of ethyl nitrite and enough distilled water to make 1000 cc.

Storage: In well-closed containers.

HALAZONE, N.N.R.

A white powder having the odor of chlorine. An organic compound containing active chlorine.

Solubility: Slightly soluble in water.

Incompatibilities: Those typical of chlorine in solution.

Action and Uses: A disinfectant used particularly for the sterilization of drinking water.

Dosage: To sterilize a liter of water, add one or two tablets of halazone. Each tablet contains 0.004 Gm. of halazone, 0.011 Gm. of sodium borate and enough sodium chloride to make 0.130 Gm.

Storage: In tight containers.

HEXAVITAMIN CAPSULES, *capsulae hexavitaminarum,* U.S.P.

Capsules containing vitamin A (fish liver oil or concentrate) 2,500 U.S.P. units; vitamin D (natural or synthetic) 200 U.S.P. units; ascorbic acid, U.S.P., 37.5 milligrams; thiamine hydrochloride, U.S.P., 1.0 milligram; riboflavin, U.S.P., 1.5 milligrams; and nicotinamide, U.S.P., 10.0 milligrams.

Action and Uses: Used in multiple vitamin deficiency

Dosage: To be determined by the physician.

Storage: In tight, light-resistant containers.

HEXYLRESORCINOL, *hexylresorcinol,* U.S.P.

White, needle-shaped crystals with a faint, fatty odor.

Solubility: In water (2000), freely in alcohol, in glycerin, in ether, in chloroform and in vegetable oils.
Action and Uses: Used as topical antiseptic, a urinary antiseptic and as an anthelmintic.
Dosage: Anthelmintic, 1 Gm. Antiseptic, 1:1000 aqueous solution.
Preparations: A 1:1000 solution of hexylresorcinol in a mixture of water and glycerin with a surface tension adjusted to 37 dynes per square centimeter is commonly used.
Evidence of Deterioration: Brownish-pink discoloration.
Storage: In tight, light-resistant containers.

HISTAMINE PHOSPHATE, *histaminae phosphas,* U.S.P. (histamine acid phosphate)
Clear, colorless, odorless, prismatic crystals. It is stable in air, but is affected by light.
Solubility: Soluble in water (4).
Action and Uses: It is used for testing the ability of the stomach to secrete hydrochloric acid. Inert when given by mouth.
Dosage: 0.3 mg.
Preparations: Histamine phosphate injection, *injectio histaminae phosphatis, U.S.P.* intramuscular, 0.3 mg.
Storage: In well-closed, light-resistant containers.

HOMATROPINE HYDROBROMIDE, *homatropinae hydrobromidum,* U.S.P.
A white, odorless powder.
Caution: It is extremely poisonous.
Solubility: In water (6) and in alcohol (40).
Incompatibilities: Alkaline hydroxides cause precipitation.
Action and Uses: Mydriatic and cycloplegic. Its effects resemble those of atropine but disappear in a shorter time.
Dosage: Usually in solution for instillation in the eye, 0.2 to 2 percent. 1 percent is most common.
Storage: In well-closed, light-resistant containers.

HYDROCHLORIC ACID, *acidum hydrochloricum,* U.S.P.
A colorless, fuming liquid having a pungent odor, containing about 36.5 percent HCl.
Caution: It should be handled with care because it is very active chemically.
Solubility: Miscible with water, alcohol, and glycerin.
Sp. Gr.: 1.18
Incompatibilities: Carbonates and bicarbonates are decomposed by it; silver salts produce a white precipitate; chlorates are decomposed with evolution of chlorine; oxides react to form soluble compounds.
Action and Uses: Caustic. Used (diluted) in gastric hypoacidity; in menstrua, to aid in the extraction of active principles from vegetable drugs; as a reagent.
Preparations: Diluted hydrochloric acid, *acidum hydrochloricum dilutum,* U.S.P. Prepared by diluting 236 cc. of hydrochloric acid with sufficient distilled water to make 1000 cc. Dose: 4 cc.
Storage: In tight containers.

HYDROGEN PEROXIDE SOLUTION, *liquor hydrogenii peroxidi,* U.S.P. (hydrogen dioxide, peroxide)
A colorless liquid containing about 3 percent H_2O_2 in aqueous solution.
Incompatibilities: Many oxidizing and reducing agents decompose it. Fluidextracts, tinctures and organic matter in general decompose it.
Action and Uses: A nontoxic local antiseptic and detergent. Used on suppurating wounds and as a mouth wash and gargle; also as a bleaching agent.
Dosage: Usually diluted about 1 in 4.
Evidence of Deterioration: A lack of effervescence when used.
Storage: In tight containers in a cool place, protected from light. The stoppers may well be paraffin coated.

HYOSCYAMUS, *hyoscyamus,* U.S.P. (henbane).
Dried leaves, with or without the tops, yielding not less than 0.04 percent of the alkaloids of hyoscyamus.
Action and Uses: Formerly employed as an antispasmodic. Now little used.
Dosage: 0.2 Gm.
Preparations: Extract of hyoscyamus, *extractum hyoscyami,* U.S.P. Both the powdered and pilular form are official. They contain about 0.15 percent of the alkaloids of hyoscyamus. Dose: 50 mg.

Fluidextract of hyoscyamus, *fluidextractum hyoscyami,* N.F. It contains about 0.04 percent of the alkaloids of hyoscyamus. Dose: 0.2 cc.

Tincture of hyoscyamus, *tinctura hyoscyami,* U.S.P. It contains about 0.004 percent of the alkaloids of hyoscyamus. Dose: 2 cc.

Evidence of Deterioration: Undue precipitation.

Storage: In well-closed containers.

ICHTHAMMOL, *ichthammol,* N.F. (ammonium ichthosulfonate)

A brownish-black, viscous fluid with a characteristic odor.

Solubility: Soluble in water and in glycerin; miscible with fixed oils and fats; partly soluble in alcohol.

Incompatibilities: Acids precipitate a resin-like mass in it; alkalies decompose it.

Action and Uses: A mildly antiseptic agent. Rarely used internally. Commonly used in ointments and suppositories.

Preparations: Ointment of ichthammol, *unguentum ichthammolis,* N.F. Ichthammol, 10 Gm., wool fat, 10 Gm., petrolatum, 80 Gm.

Storage: In tight containers.

INSULIN INJECTION, *injectio insulini,* U.S.P. (insulin)

A colorless or almost colorless liquid, free from turbidity and from insoluble matter.

Action and Uses: Increases metabolism of glucose and reduces the blood sugar. Used in the treatment of diabetes mellitus, and to stimulate the appetite.

Dosage: The dose is in accordance with the needs of the patient as determined by the physician. It is available in concentrations of 20, 40, 80, and 100 units per cc. in 10 cc. multiple-dose containers.

Evidence of Deterioration: Discoloration, turbidity or precipitation.

Storage: At temperatures above freezing but not above 15° C.

IODINE, *Iodum,* U.S.P.

Heavy, bluish-black, crystalline plates having a metallic luster.

Caution: The crystals are corrosive. Avoid contact with iron; avoid high heat.

Solubility: Very slightly in water (2950), soluble in alcohol (13), in glycerin (80), and in aqueous solution of iodides.

Incompatibilities: Alkalies react with it; alkaloids are precipitated by it; tannin and other vegetable astringents and most volatile oils react with it.

Action and Uses: Local irritant, germicide and antiseptic when applied in solution to the unbroken skin. The tincture was formerly much used in wounds but is now considered too irritating. Internally given as the solution, it acts in the same manner as potassium iodide.

Dosage: 10 mg. in solution, well diluted.

Preparations: Ampuls of iodine, *ampullae iodi,* N.F. (Iodine swabs). Iodine, 3.5 Gm., sodium iodide, 2.5 Gm., distilled water, 30 cc., alcohol to make 100 cc.

Solution of iodine, *liquor iodi,* U.S.P. Iodine, 20 Gm., sodium iodide, 24 Gm., distilled water to make 1000 cc.

Strong solution of iodine, *liquor iodi fortis,* U.S.P., (compound solution of iodine, Lugol's solution). Iodine, 5 Gm., potassium iodide, 10 Gm., distilled water to make 100 cc.

Tincture of iodine, *tinctura iodi,* U.S.P. Iodine, 70 Gm., potassium iodide, 50 Gm., distilled water, 50 cc., alcohol to make 1000 cc.

Mild tincture of iodine, *tinctura iodi mitis,* U.S.P. iodine, 20 Gm., sodium iodide, 24 Gm., diluted alcohol to make 1000 cc.

Iodine ointment, *unguentum iodi,* U.S.P. Iodine, 4 Gm., potassium iodide, 4 Gm., glycerin 12 Gm., yellow ointment to make 100 Gm.

Storage: In tightly-closed glass containers, away from heat.

IODIZED OIL, *oleum iodatum,* U.S.P.

A thick, viscous, oily liquid having an alliaceous odor and an oleaginous taste. It decomposes on exposure to air and sunlight, becoming dark brown in color. It contains about 40 percent iodine in organic combination.

Action and Uses: Used as a contrast medium.

Evidence of Deterioration: A darkened product.

Storage: In well-filled, tight, light-resistant containers.

IODOFORM, *iodoformum,* N.F. (triiodomethane)

Yellow powder or crystals with a characteristic, penetrating odor.

Solubility: Practically insoluble in water. Soluble in alcohol (60), in glycerin (80), in chloroform (10), in ether (7.5), and in olive oil (34).

Action and Uses: Used as an antiseptic dusting powder.

Storage: In tight containers, avoiding excessive heat.

IODOPHTHALEIN SODIUM, *iodophthaleinum sodicum,* U.S.P. (tetraiodophenolphthalein sodium)

A pale blue-violet, odorless powder.

Solubility: In water (7), slightly in alcohol.

Action and Uses: Used for roentgenologic examination of the gall-bladder.

Dosage: For each 10 kilograms of body weight, oral, 0.5 Gm.; intravenous, 0.3 Gm.

Evidence of Deterioration: Decomposition on exposure to air, with liberation of free phthalein.

Storage: In tight containers.

IPECAC, *ipecacuanha,* U.S.P.

Rhizome and root.

Action and Uses: Expectorant, emetic.

Dosage: Emetic, 0.5 Gm.; Expectorant, 0.06 Gm.

Preparations: Fluidextract of ipecac, *fluidextractum ipecacuanhae,* U.S.P. Syrup of ipecac, *syrupus ipecacuanhae,* U.S.P. Fluidextract of ipecac, 70 cc., glycerin, 100 cc., syrup to make 1000 cc. Dose: emetic, 8 cc.; expectorant, 1 cc.

Tincture of ipecac, *tinctura ipecacuanhae,* N.F. (may be dispensed on orders for wine of ipecac). Fluidextract of ipecac, 100 cc., diluted hydrochloric acid, 15 cc., alcohol, 200 cc., water to make 1000 cc. Dose: expectorant, 0.6 cc.

IRON AND AMMONIUM CITRATES, *ferri et ammonii citrates,* U.S.P.

Thin, transparent, garnet-red scales or granules, or a brownish-yellow powder. It is deliquescent in air and is affected by light.

Solubility: Very soluble in water; insoluble in alcohol.

Incompatibilities: Solvents containing appreciable amounts of alcohol may decompose it.

Action and Uses: Hematinic when the anemia is due to lack of iron.

Dosage: 1 Gm.

Preparations: Iron and ammonium citrates capsules, *capsulae ferri et ammonii citratum,* U.S.P. Dose: 1 Gm.

Evidence of Deterioration: A darkened or deliquesced product.

Storage: In tight, light-resistant containers.

IRON AND AMMONIUM CITRATES, GREEN, *ferri et ammonii citrates virides,* U.S.P.

Thin, transparent, green scales or granules, odorless and somewhat hygroscopic.

Caution: This is not the preferred form for oral administration.

Action and Uses: Hematinic.

Dosage: 60 mg. by parenteral injection.

Preparations: Ampuls of green iron and ammonium citrates, *ampullae ferri et ammonii citratum viridum,* N.F.

Evidence of Deterioration: Discoloration and absorption of moisture.

Storage: In tight containers, protected from light.

JUNIPER TAR, *pix juniperi,* U.S.P. (oil of cade)

A dark brown, thick liquid.

Solubility: Slightly soluble in water; soluble in alcohol (9).

Action and Uses: Formerly used in chronic inflammatory skin diseases.

Dosage: 1 to 10 percent ointment, or rarely in lotions and liniments.

Storage: In tight containers, away from excessive heat.

KAOLIN, *kaolinum,* N.F.

A white or nearly white, very fine powder.

Solubility: Insoluble in pharmaceutical solvents.

Action and Uses: As an adsorbent in diarrhea and dysentery, usually in the form of a magma. Externally, it is used as a poultice.

Preparations: Cataplasm of kaolin, *cataplasma kaolini,* N.F. 565 Gm. of recently dried kaolin is mixed with 45 Gm. of boric acid and incorporated with 387 Gm. of glycerin which has been recently heated to 100° C. 5 Gm. of thymol is dissolved in 2 cc. of methyl salicylate and 0.5 cc. of oil of peppermint and the solution is added to the mass.

Storage: In well-closed containers.

LACTIC ACID, *acidum lacticum,* U.S.P.

A colorless or slightly yellow, nearly odorless, syrupy liquid containing a mixture of lactic acid and lactic anhydride equivalent to about 87.5 percent lactic acid.

Solubility: Miscible with water, alcohol, glycerin and ether.

Sp. Gr.: 1.206

Incompatibilities: Carbonates and bicarbonates are decomposed by it; albumin is coagulated.
Action and Uses: Used in the form of lactic acid milk in infant feeding, to neutralize the excess base of cow's milk. Externally, as a caustic.
Dosage: 1 cc.
Storage: In tight containers.

LACTOSE, *lactosum,* U.S.P. (sugar of milk, *saccharum lactis*)
A white, crystalline powder.
Solubility: Soluble in water (5); very slightly in alcohol.
Action and Uses: For modification of cow's milk in the feeding of infants and invalids; as a diluent for powders; as a base of tablet triturates.
Preparations: Triturations, *triturationes,* U.S.P.
Storage: In well-closed containers.

LARD, *adeps,* U.S.P.
A soft, white, unctuous mass, having a faint odor and a bland taste, free from rancidity.
Solubility: Insoluble in water; very slightly soluble in alcohol; readily soluble in ether and in chloroform.
Melting Point: 36° to 42° C.
Incompatibilities: Its melting point is lowered upon admixture with camphor, menthol, phenol, thymol, and chloral hydrate.
Action and Uses: A base for ointments.
Preparations: Benzoinated lard, *adeps benzoinatus,* U.S.P.
Evidence of Deterioration: A rancid product.
Storage: In well-closed containers, in a cool place.

LEAD ACETATE, *plumbi acetas,* U.S.P. (sugar of lead, *sal saturni*). Colorless, shining, transparent prisms or plates, or heavy, white crystalline masses, or granular crystals. It has a faintly acetous odor, is efflorescent, and absorbs carbon dioxide on exposure to air, becoming incompletely soluble in water.
Solubility: Soluble in water (1.6) and in alcohol (30). It is freely soluble in glycerin.
Incompatibilities: Soluble sulfates and vegetable extractions are precipitated by it.
Action and Uses: Externally, as an astringent lotion. Its use is declining. Not used internally owing to danger of lead poisoning.
Preparations: An ingredient of lotion of lead and opium, *lotio plumbi et opii,* N.F. (lead and opium wash)
Evidence of Deterioration: An effloresced product which is incompletely soluble in water.
Storage: In tight containers.

LIME, *calx,* N.F. (unslaked lime, calcium oxide, quicklime)
Hard, white or grayish-white masses or granules, or a white powder.
Solubility: Slightly soluble in water (840). It is soluble in glycerin and in syrup. Insoluble in alcohol.
Action and Uses: Reagent.
Evidence of Deterioration: Soft, friable masses, or a powder.
Storage: In tight containers.

LINSEED OIL, *oleum lini,* U.S.P. (oil of flaxseed, raw linseed oil)
A yellowish-brown fixed oil.
Caution: Do not use "boiled" linseed oil.
Solubility: Miscible with ether, chloroform, petroleum benzin and oil of turpentine.
Sp. Gr.: 0.930
Action and Uses: Externally as a protective emollient.
Preparations: Lime liniment, *linimentum calcis,* N.F. (carron oil). Equal volumes of linseed oil and solution of calcium hydroxide mixed by agitation. A water-in-oil emulsion.
Evidence of Deterioration: Hard, dry surface film.
Storage: In tight containers.

LITHIUM CITRATE, *lithii citras,* N.F.
A white, odorless powder.
Solubility: Soluble in water (1.4); very slightly in alcohol.
Action and Uses: The same as other alkaline citrates.
Dosage: 0.5 Gm.
Preparations: Effervescent salt of lithium citrate, *sal lithii citratis effervescens,* N.F.

Lithium citrate, 50 Gm., sodium bicarbonate, 570 Gm., tartaric acid, 300 Gm., citric acid, 195 Gm.

Storage: In tight containers.

LIVER, *hepar*

The soluble thermostable fraction of mammalian livers which increases the number of red blood corpuscles in the blood of persons suffering from pernicious anemia, in the form of the preparations listed below.

Action and Uses: Used in the treatment of pernicious anemia.

Preparations: Extract of liver, *extractum hepatis,* U.S.P. (dry liver extract). Dose: One U.S.P. unit.

Liver injection, *injectio hepatis,* U.S.P. Dose: Intramuscular, 1 U.S.P. unit.

Solution of liver, *liquor hepatis,* U.S.P. (liquid extract of liver). Dose: One U.S.P. unit.

Storage: In well-closed containers, preferably at a temperature not above 20° C, and protected from light.

MAGNESIUM CARBONATE, *magnesii carbonas,* U.S.P. (hydrated magnesium carbonate)

A white powder or white, friable blocks, equivalent to 40 to 43.5 percent MgO. It occurs in various densities, the light being used as a diffusing agent.

Solubility: Practically insoluble in water but imparts an alkaline reaction to it; insoluble in alcohol; soluble in dilute acids.

Incompatibilities: Acids decompose it.

Action and Uses: Internally, against gastric hyperacidity, and as a mild laxative; externally, as an absorbent dusting powder. Used in syrup of tolu balsam and syrup of ginger as a diffusing agent; an ingredient of solution of magnesium citrate.

Dosage: Antacid, 0.6 Gm.; laxative, 8 Gm.

Storage: In well-closed containers.

MAGNESIUM OXIDE, *magnesii oxidum,* U.S.P. (magnesia, light magnesia, light calcined magnesia, magnesia usta)

A light, white powder.

Solubility: Practically insoluble in water and in alcohol. It forms a gel with 15 parts of water. It dissolves in dilute acids.

Action and Uses: Antacid and laxative, in powders.

Dosage: Antacid, 0.25 Gm.; laxative, 4 Gm.

Evidence of Deterioration: Effervesces with acids due to absorption of carbon dioxide from the air.

Storage: In well-closed containers.

MAGNESIUM OXIDE, HEAVY, *magnesii oxidum ponderosum,* U.S.P. (heavy calcined magnesia, heavy magnesia)

A dense, white powder.

Solubility: Practically insoluble in water and alcohol. Soluble in dilute acids.

Action and Uses: Antacid and laxative, in powders or in liquid mixtures.

Dosage: Antacid, 0.25 Gm., laxative, 4 Gm.

Storage: In well-closed containers.

MAGNESIUM SULFATE, *magnesii sulfas,* U.S.P. (epsom salt)

Small colorless crystals.

Solubility: Soluble in water (1); practically insoluble in alcohol; slowly in glycerin (1), with the aid of gentle heat.

Incompatibilities: Alcohol will precipitate it from concentrated aqueous solutions.

Action and Uses: In solution, by mouth as saline cathartic; intravenously and intramuscularly in tetanus and uremia as an anticonvulsant; and as a local application in inflammatory conditions.

Dosage: 15 Gm. as a cathartic. In convulsive states, intramuscularly, 0.6 cc. of a 25 percent solution for each kilogram (2.2 pounds) of body weight, six times daily.

Preparations: Ampuls of magnesium sulfate, *ampullae magnesii sulfatis,* N.F.

Effervescent salt of magnesium sulfate, *sal magnesii sulfatis effervescens,* N.F. magnesium sulfate, 500 Gm., sodium bicarbonate, 403 Gm., tartaric acid, 211 Gm., citric acid, 136 Gm.

Evidence of Deterioration: Efflorescence.

Storage: In well-closed containers.

MAPHARSEN, N.N.R.

A white, amorphous, odorless powder. An organic compound containing trivalent arsenic.

Solubility: Soluble in water and in alcohol.
Action and Uses: Antiluetic.
Dosage: Intravenous, 0.04 Gm. (women), 0.06 Gm. (men)
Preparations: Ampuls, 0.04 and 0.06 Gm.
Storage: In a cool place, preferably not above 20° C., in hermetic containers of colorless glass from which the air has been excluded either by the production of a vacuum or by displacement with a non-oxidizing gas.

MENADIONE, *menadionum,* U.S.P.
A bright yellow, crystalline powder; an analogue of vitamin K. It is affected by sunlight.
Caution: It is irritating to the respiratory tract and to the skin, and in alcoholic solution has vesicant properties.
Solubility: Practically insoluble in water; soluble in alcohol (60); soluble in vegetable oils.
Action and Uses: Used in vitamin K deficiency.
Dosage: 1 mg.
Preparations: Menadione tablets, *tabellae menadioni,* U.S.P. Dose: 1 mg.
Storage: In well-closed, light-resistant containers.

MENTHOL, *menthol,* U.S.P.
Volatile, colorless crystals or crystalline powder having a peppermint-like odor.
Solubility: Slightly soluble in water; very soluble in alcohol, in chloroform, in ether, and in petroleum benzin. Freely soluble in liquid petrolatum and in fixed and volatile oils.
Incompatibilities: It liquefies when triturated with camphor, chloral hydrate, phenol or thymol.
Action and Uses: Used locally as a counterirritant and analgesic, particularly in liniments; rarely, internally as a carminative; commonly in solution in oil as nasal spray or drops (0.060 Gm. to 0.400 Gm. per 30 cc.).
Dosage: 0.060 Gm.
Preparations: Camphorated menthol, *menthol camphoratum,* N.F. Mix equal quantities of menthol and camphor and warm the mixture until solution is effected.
Compound menthol spray, *nebula mentholis composita,* N.F. Dissolve 10 Gm. of menthol, 10 Gm. of camphor, 5 cc. of methyl salicylate, and 5 cc. of eucalyptol in light liquid petrolatum to make 1000 cc.
Compound menthol ointment, *unguentum mentholis compositum,* N.F. Dissolve 10 Gm. of menthol in 10 Gm. of methyl salicylate and mix the solution with the base made by melting 5 Gm. of white wax and 75 Gm. of hydrous wool fat.
Storage: In tight containers, preferably at a temperature below 30° C.

MERBROMIN, *merbrominum,* N.F.
Iridescent, green scales or granules. An organic compound of mercury. It is odorless, and is permanent in the air.
Solubility: Freely soluble in water, practically insoluble in alcohol and in acetone, and insoluble in chloroform and in ether.
Incompatibilities: Acids decompose it.
Action and Uses: A moderately active antiseptic used in varying strengths of solutions and tinctures.
Preparations: Solution of merbromin, *Liquor merbromini,* N.F. Merbromin, 20 Gm., distilled water, sufficient to make 1000 cc.
Surgical solution of merbromin, *liquor merbromini chirurgicalis,* N.F. Dissolve 20 Gm. of merbromin in 350 cc. of distilled water. Add 100 cc. of acetone and sufficient alcohol to make 1000 cc.
Storage: In tight containers.

MERCRESIN
A solution of orthohydroxyphenylmercuric chloride and secondary amyltricresols in an alcohol-acetone base.
Action and Uses: Antiseptic and germicide for topical application.
Dosage: The tinctures are used undiluted for application to intact skin; for other uses, dilutions of the tinctures are used.
Preparations: Tincture mercresin, tincture mercresin stainless.
Storage: In tight containers.

MERCURIC CYANIDE, *hydrargyri cyanidum,* N.N.R.
Colorless crystals or a white powder. It darkens on exposure to light.
Caution: It is a violent poison.

Solubility: Soluble in water (13) and in alcohol (13).
Action and Uses: Antiseptic, formerly also used as an antisyphilitic.
Dosage: 4 mg. For application to mucous surfaces, 1–4000 to 1–2000 aqueous solutions.
Evidence of Deterioration: A darkened product.
Storage: In tight, light-resistant containers.

MERCURIC IODIDE, RED, *hydrargyri iodidum rubrum,* N.F. (biniodide of mercury, deutoiodide of mercury).
A scarlet-red, odorless, nearly tasteless powder.
Caution: Very poisonous. Very irritating to mucous surfaces and the skin. It should not be dispensed undissolved in liquid preparations.
Solubility: Practically insoluble in water; slightly soluble in alcohol (115); readily soluble in solution of iodides.
Incompatibilities: Alkaloids may be precipitated by its solution.
Action and Uses: Dissolved in a solution of either potassium or sodium iodide, it was formerly used as an antiseptic, germicide and antisyphilitic. Applied in an ointment or as a powder, it is a vesicant.
Dosage: 4 mg.
Preparations: Tablets of red mercuric iodide, *tabellae hydrargyri iodide rubri,* N.F. Solution of arsenic and mercuric iodides, *liquor arseni et hydrargyri iodidorum,* N.F. (Donovan's solution) Dose: 0.1 cc.
Evidence of Deterioration: Discoloration by action of light.
Storage: In well-closed containers, protected from light.

MERCURIC OXIDE, YELLOW, *hydrargyri oxidum flavum,* U.S.P. (yellow precipitate)
An orange-yellow, heavy, odorless powder.
Solubility: Insoluble in water and in alcohol.
Incompatibilities: Iron utensils react with it, causing discoloration.
Action and Uses: Antiseptic, usually in the form of an ointment for ophthalmic use.
Preparations: Yellow mercuric oxide ointment, *unguentum hydrargyri oxidi flavi,* U.S.P. 1 Gm. of yellow mercuric oxide is levigated with 1 Gm. of liquid petrolatum and incorporated with 98 Gm. of yellow ointment.
Oleate of mercury, *oleatum hydrargyri,* U.S.P. Mix 25 Gm. of yellow mercuric oxide with 75 Gm. of oleic acid, warm the mixture to a temperature not above 50° C., stirring until the mercuric oxide is dissolved.
Evidence of Deterioration: Darkening usually caused by exposure to strong light.
Storage: In well-closed, light-resistant containers.

MERCURIC OXYCYANIDE, *hydrargyri oxycyanidum,* N.N.R.
White crystals or a crystalline powder. It contains about 33 percent mercuric oxycyanide and 67 percent mercuric cyanide.
Caution: It is a violent poison.
Solubility: In water (80).
Action and Uses: Antiseptic, formerly also used as an antisyphilitic.
Dosage: 4 mg. For application to mucous surfaces, 1:4000 to 1:2000 aqueous solutions.
Evidence of Deterioration: A darkened product.
Storage: In tight, light-resistant containers.

MERCURIC SALICYLATE, *hydrargyri salicylas,* U.S.P.
A white, or slightly yellow or slightly pink powder. It is affected by light.
Solubility: Practically insoluble in water and in alcohol.
Action and Uses: Formerly widely used as an antisyphilitic, but Hg is being supplanted by Bi for this purpose.
Dosage: Intramuscular, in oil, 60 mg.
Preparations: Mercuric salicylate injection, *injectio hydrargyri salicylatis,* U.S.P. Dose: 0.1 Gm.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

MERCURIC SUCCINIMIDE, *hydrargyri succinimidum,* U.S.P.
Small, white crystals or white powder. It is stable in air but darkens on exposure to light.
Solubility: Soluble in water (20); slightly soluble in alcohol.
Action and Uses: Formerly widely used as an antisyphilitic, but Hg is being supplanted by Bi for this purpose.
Dosage: Intramuscular, 15 mg.

Preparations: Ampuls of mercuric succinimide, *ampullae hydrargyri succinimidi,* N.F. Dose: 10 mg.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

MERCUROUS CHLORIDE, MILD, *hydrargyri chloridum mite,* U.S.P. (calomel, subchloride of mercury).
A heavy, white, odorless powder.
Solubility: Insoluble in all of the pharmaceutical solvents.
Incompatibilities: Alkalies, soluble bromides, and iodides react with it.
Action and Uses: A slow, fairly powerful and relatively nonirritant cathartic, but this use is declining. Danger of salivation if taken continuously. Usually dispensed in dry forms such as tablets, pills, and capsules. Employed in dusting powders and in lotions. Dispensed in ointments for venereal prophylaxis.
Dosage: 0.12 Gm., usually in divided doses of 0.006 to 0.015 Gm.
Preparations: Compound pills of mild mercurous chloride, *pilulae hydrargyri chloridi mitis compositae,* N.F. (compound cathartic pills). Each pill contains mild mercurous chloride, 0.06 Gm., compound extract of colocynth, 0.08 Gm., resin of jalap, 0.02 Gm., gamboge, 0.015 Gm. The excipient is diluted alcohol.
Tablets of mild mercurous chloride, *tabellae hydrargyri chloridi mitis,* N.F. (calomel tablets).
Tablets of mild mercurous chloride and sodium bicarbonate, *tabellae hydrargyri chloridi mitis et sodii bicarbonatis,* N.F. (calomel and soda). Ointment of mild mercurous chloride, *unguentum hydrargyri chloridi mitis,* N. F. (calomel ointment). Mild mercurous chloride, 30 Gm., hydrous wool fat, 35 Gm., white petrolatum, 35 Gm.
Evidence of Deterioration: Grayish discoloration. Container should be dated and the product in it should be discarded after three years' storage.
Storage: In well-closed, light-resistant containers.

MERCURY BICHLORIDE, *hydrargyri bichloridum,* U.S.P. (corrosive sublimate)
Heavy, odorless crystals or a crystalline powder.
Caution: Very poisonous: concentrated solutions are caustic.
Solubility: Slowly in water (13.5), in alcohol (3.8), in glycerin (12), in ether (25). Readily dissolved in boiling water. Ammonium chloride, sodium chloride, and citric acid aid in dissolving it.
Incompatibilities: Alkalies, calcium hydroxide, soap, lead acetate, and many organic compounds cause precipitation.
Action and Uses: Chiefly as a germicide and antiseptic; also as an antisyphilitic agent. Rarely used except in dilute solution.
Dosage: 4 mg. As an antiseptic, solution 1:20,000 to 1:2000. As a disinfectant of clothing, solution 1:1000.
Preparations: Large poison tablets of mercury bichloride, *toxitabellae hydrargyri bichloridi magnae,* U.S.P. Each tablet contains about 0.5 Gm. Added to a pint of water it makes a 1:1000 solution.
Small poison tablets of mercury bichloride, *toxitabellae hydrargyri bichloridi parvae,* U.S.P. Each tablet contains about 0.125 Gm. Added to a pint of water it makes a 1:4000 solution.
Storage: In well-closed containers.

MERCURY, *hydrargyrum,* U.S.P.
A shining, silvery, odorless metal, liquid at ordinary temperatures.
Solubility: Insoluble in ordinary solvents.
Sp. Gr.: 13.5.
Action and Uses: In ointment form, it was formerly used by inunction in the treatment of syphilis.
Preparations: Mercury with chalk, *hydrargyri cum creta,* U.S.P. Contains about 38 percent metallic mercury. Dose: 0.25 Gm.
Strong mercurial ointment, *unguentum hydrargyri forte,* U.S.P. Contains about 50 percent metallic mercury subdivided with oleate of mercury, 2 percent, in a base of wool fat, 30 percent, white wax, 5 percent, and white petrolatum, 13 percent.
Mild mercurial ointment, *unguentum hydrargyri mite,* U.S.P. (blue ointment, blue butter). Contains about 10 percent metallic mercury. Prepared by diluting strong mercurial ointment, 20 percent, with white ointment, 80 percent.
Storage: In strong, tight containers.

MERSALYL AND THEOPHYLLINE INJECTION, *mersalylis et theophyllinae, injectio,* U.S.P.
A sterile solution of approximately 10 parts by weight of mersalyl and 5 parts by weight of theophylline in water for injection.
Action and Uses: Diuretic.
Dosage: Intramuscular or intravenous in an amount equivalent to mersalyl, 0.2 Gm., and theophylline, 0.1 Gm.
Storage: In hermetic containers.

MERTHIOLATE, N.N.R.
A light, cream-colored, nonhygroscopic, crystalline powder stable in air but unstable in sunlight, containing approximately 50 percent mercury in organic combination.
Solubility: Soluble in water (1) and in alcohol (8).
Action and Uses: Germicide and fungicide.
Dosage: For disinfection of instruments, 1:1000 aqueous solution; for application to intact skin, tincture, 1:1000; for application to wounds and denuded surfaces, aqueous solution, 1:1000; for application to mucous surfaces, 1:5000 to 1:30,000.
Preparations: Tincture merthiolate, 1:1000; merthiolate solution, 1:1000; merthiolate jelly, 1:1000.
Storage: In tight, light-resistant containers.

METAPHEN, N.N.R.
A yellow, odorless and tasteless substance containing approximately 56 percent mercury in organic combination.
Solubility: Insoluble in water, almost insoluble in methyl alcohol, acetone, and ether; soluble in dilute aqueous solutions of sodium hydroxide and ammonium hydroxide.
Action and Uses: Germicide and fungicide.
Dosage: For disinfection of instruments, aqueous solution, 1:5000 to 1:1000; for application to the skin, 1:5000 to 1:1000; for ophthalmological and urethral uses, 1:10,000 to 1:5000.
Preparations: Solution metaphen, 1:500; tincture metaphen, 1:200.
Storage: In tight containers.

METHENAMINE, *methenamina, U.S.P.* (hexamethylenetetramine).
Colorless crystals or a white powder, nearly odorless and with a sweetish taste.
Solubility: Soluble in water (1.5), and in alcohol (12.5).
Incompatibilities: Acids, ammonium salts, mercuric chloride, and tannin are incompatible with it.
Action and Uses: Urinary antiseptic through liberation of formaldehyde in the presence of acids. Sodium biphosphate is commonly given before it in order to render the urine acid. Less effective than the sulfonamides, its use is declining. Tablets of it are sometimes ignited and used as an emergency laboratory fuel in heating liquids in test tubes.
Dosage: 0.5 Gm. in solution.
Preparations: Methenamine tablets, *tabellae methenaminae,* U.S.P.
Storage: In well-closed containers.

METHYL SALICYLATE, *methylis salicylas,* U.S.P. (oil of gaultheria, oil of wintergreen, oil of sweet birch).
A colorless or amber liquid with a characteristic, wintergreen odor and taste.
Solubility: Slightly soluble in water, soluble in alcohol and in 70 percent alcohol (7).
Sp. Gr.: 1.18.
Action and Uses: A counterirritant, antirheumatic, internally and externally. Frequently included as an ingredient of liniments and inunctions; commonly used as a flavor.
Dosage: 0.75 cc.
Preparations: Wintergreen water, *aqua gaultheriae,* N.F. 5 cc. of methyl salicylate is dissolved in distilled water to make 1000 cc., employing the general process.
Storage: In tight containers.

METHYLROSANILINE CHLORIDE, *methylrosanilinae chloridum,* U.S.P.
(gentian violet, crystal violet, methyl violet)
Dark-green powder or pieces having a metallic luster.
Caution: Use great care in handling it; it stains most substances. In some cases the stains may be removed with acidified alcohol.
Solubility: Soluble in water (40), in alcohol (10), in glycerin (15). Insoluble in ether but soluble in chloroform.
Action and Uses: Antiseptic, in solution; anthelmintic, in enteric coated tablets or capsules.
Dosage: 0.06 Gm. A 1 percent solution is used topically.

Preparations: Solution of methylrosaniline chloride, *liquor methylrosanilini chloridi,* N.F. (solution of gentian violet, solution of crystal violet). Dissolve 10 Gm. of methylrosaniline chloride in 100 cc. of alcohol and enough water to make 1000 cc.
Storage: In well-closed containers.

METHYLTHIONINE CHLORIDE, *methylthioninae chloridum,* U.S.P. (methylene blue) Dark green, odorless crystals or a crystalline powder, having a bronze-like luster. It is stable in air. Solutions of methylthionine chloride have a deep blue color.
Solubility: Soluble in water (25) and in alcohol (65).
Action and Uses: Formerly used as a weak antiseptic and anthelmintic; now chiefly used as a reagent.
Dosage: 0.15 Gm.
Storage: In well-closed containers.

METRAZOL, N.N.R.
White crystals.
Solubility: Freely soluble in water.
Action and Uses: Respiratory stimulant and convulsant. Used in treatment of overdose of barbiturates.
Dosage: Intramuscular, subcutaneous, or intravenous, 0.1 to 0.3 Gm., repeated as required; oral 0.1 to 0.3 Gm.
Preparations: Ampuls, 0.1 Gm.; tablets, 0.1 Gm.
Storage: In tight containers.

METYCAINE, N.N.R.
A white, crystalline powder.
Solubility: Soluble in water (1); soluble in alcohol and chloroform.
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Local anesthetic.
Dosage: 0.5 to 10 percent aqueous solutions.
Storage: In well-closed containers.

MORPHINE SULFATE, *morphinae sulfas,* U.S.P.
White, odorless crystals or masses.
Caution: Potent narcotic. Guard it properly.
Solubility: Soluble in water (16), slightly in alcohol (570). Insoluble in ether and in chloroform.
Action and Uses. It depresses the brain, causing analgesia and hypnosis, relieving cough, and lessening bowel movements. Almost inactive locally. Commonly available in hypodermic tablets. Danger of addiction.
Dosage: 10 mg.
Preparations: Tablets of morphine and atropine sulfates, *tabellae morphinae et atropinae sulfatum,* N.F. Morphine sulfate, 15 mg., atropine sulfate 0.4 mg.
Tablets of morphine sulfate, *tabellae morphinae sulfatis,* U.S.P. 10 mg., 15 mg., 30 mg.
Storage: In tight, light-resistant containers.

MYRRH, *myrrha,* U.S.P. (gum myrrh)
An oleo-gum-resin.
Solubility: Incompletely soluble in alcohol. It forms an emulsion when triturated with water.
Action and Uses: Carminative and protective. Little used today.
Preparations: Tincture of myrrh, *tinctura myrrhae,* U.S.P. A 20 percent tincture prepared by maceration, using alcohol as the solvent. Dose: 2 cc.
Storage: In well-closed containers.

NEOARSPHENAMINE, *neoarsphenamina,* U.S.P.
A yellow, odorless powder, readily oxidized by exposure to air. An organic trivalent arsenic compound.
Caution: Solutions of it must be freshly prepared and should not be agitated in the process of preparation.
Solubility: Very soluble in water; soluble in glycerin; slightly soluble in alcohol.
Action and Uses: A specific remedy for syphilis.
Dosage: Intravenous, 0.45 Gm., dissolved in cold water.
Evidence of deterioration: Darkening. It is not safe to use it more than three years from the date of original release by the National Institute of Health.
Storage: In a cool place, in sealed tubes from which the air has been excluded.

NEOSTIGMINE BROMIDE, *neostigminae bromidum,* U.S.P.
A white, crystalline powder having a bitter taste.
Solubility: Soluble in water and in alcohol.
Action and Uses: Used in the oral treatment of myasthenia gravis.
Dosage: Oral, 15 mg.
Preparations: Neostigmine bromide tablets, *tabellae neostigminae bromidi,* U.S.P. 15 mg.
Storage: In tight containers.

NEOSTIGMINE METHYLSULFATE, *neostigminae methylsulfas,* U.S.P.
A white, crystalline, odorless powder having a bitter taste.
Solubility: Soluble in water (10); less soluble in alcohol.
Action and Uses: Used for postoperative distention, and for the treatment of myasthenia gravis.
Dosage: Subcutaneous or intramuscular, 0.5 mg.
Preparations: Neostigmine methylsulfate injection, *injectio neostigminae methylsulfatis,* U.S.P.
Storage: In tight containers.

NEO-SYNEPHRINE HYDROCHLORIDE, N.N.R.
White, odorless crystals, having a bitter taste. Chemically related to ephedrine.
Solubility: Freely soluble in water and in alcohol.
Incompatibilities: Alkalies and iodine precipitate it. Metals discolor its solutions.
Action and Uses: Vasoconstrictor, used especially locally on the nasal mucous membrane.
Dosage: 5 mg. For local application, 0.25 to 1 percent aqueous solutions.
Storage: In well-closed containers.

NICOTINAMIDE, *nicotinamidum,* U.S.P. (nicotinic acid amide, niacinamide)
A white, crystalline powder, odorless or nearly so, and having a bitter taste.
Solubility: Soluble in water (1), in alcohol (1.5), and in glycerin (10).
Action and Uses: Antipellagric.
Dosage: 25 mg.
Preparations: Nicotinamide tablets, *tabellae nicotinamidi,* U.S.P., 25 mg. and 50 mg.
Storage: In tight containers.

NICOTINIC ACID, *acidum nicotinicum,* U.S.P. (niacin)
White crystals or a crystalline powder. A vitamin of the B group.
Solubility: Soluble in water (60).
Action and Uses. Antipellagric.
Dosage: 25 mg.
Preparations: Nicotinic acid tablets, *tabellae acidi nicotinici,* U.S.P. Dose: 25 mg.
Storage: In well-closed containers.

NIKETHAMIDE, N.N.R.
A clear, colorless to pale yellow, somewhat viscous liquid, having a slight, characteristic, aromatic odor and a peculiar, bitter taste.
Action and Uses: Respiratory stimulant and convulsant.
Dosage: Intravenous, 3 to 5 cc. of a 25 percent solution; rarely used orally.
Storage: In tight containers.

NITRIC ACID, *acidum nitricum,* U.S.P.
A colorless, fuming liquid, very caustic and corrosive and having a characteristic, highly irritating odor. It contains about 69 percent HNO_3.
Caution: Destructive to living tissues and to fabrics and should be handled with extreme caution.
Solubility: Miscible with water.
Sp. Gr.: 1.41. Boils: 120° C.
Incompatibilities: In addition to the incompatibilities common to most acids, it acts on many metals with the evolution of brownish-red fumes.
Action and Uses: Caustic, corrosive and escharotic; in diluted form, an astringent. Used for cauterization of certain wounds.
Preparations: Nitrohydrochloric acid, *acidum nitrohydrochloricum,* N.F. (*aqua regia,* nitromuriatic acid).
A concentrated aqueous solution containing hydrochloric acid, nitric acid, nitrosyl chloride, and chlorine.
Mix 20 cc. of nitric acid with 80 cc. of hydrochloric acid in a suitable vessel and let stand, loosely-stoppered, for 15 hours or until the gas ceases to evolve. Dose: 0.2 cc.

Diluted nitrohydrochloric acid, *acidum nitrohydrochloricum dilutum,* N.F. Prepared by mixing 22 cc. of nitrohydrochloric acid with distilled water to make 100 cc. Dose: 1 cc.

Note. Do not dispense either nitrohydrochloric acid or diluted nitrohydrochloric acid if iodine is not immediately liberated when one drop of the acid is added to 1 cc. of an aqueous solution of potassium iodide (1–5).

Evidence of Deterioration: On exposure to light, especially in partly-filled containers, it becomes yellowish-brown due to the formation of nitrogen oxides.

Storage: In tight containers.

NORMAL HUMAN SERUM, *serum humanum normale,* U.S.P. (human serum)

The serum of pooled human blood in liquid or dried state.

Action and Uses: Used in surgical and traumatic shock, in the treatment of burns, and in hemorrhage.

Dosage: Intravenous, 500 cc.

Storage: In hermetic containers. The liquid serum should be kept at a temperature between 2° and 10° C.; the dried serum must not be exposed to excessive heat.

NUPERCAINE HYDROCHLORIDE, N.N.R.

A fine, white, crystalline, odorless, hygroscopic powder.

Solubility: Very soluble in water, freely soluble in alcohol.

Incompatibilities: Alkalies precipitate it.

Action and Uses: A local anesthetic similar to cocaine when applied to mucous surfaces and to procaine or cocaine when injected, the action being relatively prolonged. It is used for local infiltration, spinal, and sacral anesthesia.

Dosage: For infiltration anesthesia, solution 1:2000 to 1:1000 (not more than 100 cc. of a 1:1000 solution should be injected.)

Preparations: Ampuls, 1:200, 1:1000, 1:1500; solution, 2 percent; tablets, 50 mg.

Storage: In tight containers.

NUX VOMICA, *nux vomica,* U.S.P.

Seeds yielding not less than 1.15 percent of strychnine.

Incompatibilities: Same as strychnine.

Action and Uses: A bitter to stimulate appetite. Its use is declining.

Dosage: 0.1 Gm.

Preparations: Extract of nux vomica, *extractum nucis vomicae,* N.F. (*extractum strychni,* P.I.) 7.5 percent strychnine. Dose: 15 mg.

Fluidextract of nux vomica, *fluidextractum nucis vomicae,* N.F. 1.15 percent strychnine. Dose: 0.1 cc.

Tincture of nux vomica, *tinctura nucis vomicae,* U.S.P. (*tinctura strychni,* P.I.) 0.115 percent strychnine. Dose: 1 cc.

Storage: In well-closed containers.

OIL OF ANISE, *oleum anisi,* U.S.P.

A colorless or pale yellow volatile oil from anise.

Caution: If solid material has separated, carefully warm the mixture until it is completely liquefied and mix it thoroughly.

Solubility: Soluble in alcohol (3).

Congeals: 15° C.

Action and Uses: Aromatic carminative and flavor.

Preparations: Anise water, *aqua anisi,* U.S.P. A saturated aqueous solution prepared by the general process. Dose: 15 cc.

Spirit of anise, *spiritus anisi,* U.S.P. A 10 percent solution of oil of anise in alcohol. Dose: 1 cc., diluted.

Storage: In well-filled, tight containers away from excessive heat.

OIL OF CHENOPODIUM, *oleum chenopodii,* U.S.P.

A pale yellow volatile oil.

Solubility: Soluble in 70 percent alcohol (8).

Action and Uses: Anthelmintic, especially for roundworms and hookworms.

Dosage: Caution. As an anthelmintic for adults, single dose, 1 cc.

Preparations: Oil of chenopodium capsules, *capsulae olei chenopodii,* U.S.P., 1 cc.

Storage: In tight containers, away from excessive heat.

OIL OF CINNAMON, *oleum cinnamomi,* U.S.P. (oil of Cassia)

A yellowish-brown volatile oil.

Solubility: Soluble in alcohol (1) and in 70 percent alcohol (2).

Action and Uses: Aromatic flavor.

Preparations: Cinnamon water, *aqua cinnamomi,* U.S.P. A saturated aqueous solution prepared by the general process. Dose: 15 cc.

Spirit of cinnamon, *spiritus cinnamomi,* U.S.P. A 10 percent alcoholic solution of oil of cinnamon. Dose: 1 cc.

Syrup of cinnamon, *syrupus cinnamomi,* N.F. Prepared by mixing 0.5 cc. of oil of cinnamon with 60 cc. of compound tincture of cudbear and enough syrup to make 1000 cc.

Evidence of Deterioration: Darkening and thickening.

Storage: In well-filled, tight containers, away from excessive heat.

OIL OF CORIANDER, *oleum coriandri,* U.S.P.

A colorless or pale yellow volatile oil.

Solubility: Soluble in 70 percent alcohol (3).

Action and Uses: Formerly used as an aromatic carminative.

Storage: In well-filled, tight containers, away from excessive heat.

OIL OF JUNIPER, *oleum juniperi,* U.S.P.

A colorless or faintly greenish-yellow volatile oil.

Solubility: Soluble in alcohol (4).

Action and Uses: Once used as an irritant diuretic. Now discredited. A flavor.

Storage: In well-filled, tight containers, away from excessive heat.

OIL OF LEMON, *oleum limonis,* U.S.P.

A yellowish volatile oil.

Solubility: Soluble in alcohol (3).

Action and Uses: Flavor.

Evidence of Deterioration: A terebinthinate odor.

Storage: In well-filled, tight containers, away from excessive heat.

OIL OF ORANGE, *oleum aurantii,* U.S.P. (oil of sweet orange)

A yellow or orange volatile oil from the fresh peel of the ripe fruit.

Solubility: Soluble in alcohol (2).

Action and Uses: Aromatic flavor.

Preparations: Compound spirit of orange, *spiritus aurantii compositus,* U.S.P. It is prepared by dissolving 200 cc. of oil of orange, 50 cc. of oil of lemon, 20 cc. of oil of coriander, and 5 cc. of oil of anise, in enough alcohol to make 1000 cc.

Evidence of Deterioration: A terebinthinate odor.

Storage: In well-filled, tight containers, away from excessive heat.

OIL OF PEPPERMINT, *oleum menthae piperitae,* U.S.P.

A colorless volatile oil.

Solubility: Soluble in 70 percent alcohol (4).

Action and Uses: Aromatic carminative and flavor.

Preparations: Peppermint water, *aqua menthae piperitae,* U.S.P. A saturated aqueous solution of oil of peppermint prepared by the general process. Dose: 15 cc.

Spirit of Peppermint, *spiritus menthae piperitae,* U.S.P. (essence of peppermint). Dose: 1 cc.

10 Gm. of peppermint leaves are macerated for 1 hour in 500 cc. of water and then expressed. The moist leaves are macerated for 6 hours in 900 cc. of alcohol and then the mixture is filtered. 100 cc. of oil of peppermint is added to the filtrate and enough alcohol to make 1000 cc.

Storage: In tight containers.

OIL OF SANTAL, *oleum santali,* N.F.

A pale yellow, somewhat viscid volatile oil.

Solubility: Soluble in 70 percent alcohol (5).

Action and Uses: Urinary antiseptic. Formerly used in the treatment of gonorrhea.

Dosage: 0.5 cc., usually in capsules.

Storage: In tight containers, protected from light.

OIL OF TURPENTINE, *oleum terebinthinae,* U.S.P. (spirits of turpentine)

A colorless volatile oil.

Solubility: Soluble in alcohol (5).

Action and Uses: Rubefacient and counterirritant when applied to the skin. Formerly used internally, but now considered too toxic.

Preparations: Rectified oil of turpentine, *oleum terebinthinae rectificatum.* Prepared by distilling a mixture of equal volumes of oil of turpentine and 5 percent aqueous solution of sodium hydroxide. The oil is separated from the water in the distillate and is dried by agitating it with anhydrous calcium chloride. Dose: 0.3 cc.

Acetic turpentine liniment, *linimentum terebinthinae aceticum,* N.F. (Stoke's

liniment). Triturate 400 cc. of oil of turpentine and 16 cc. of oil of lemon with the contents of two eggs and the yolks of two others. Add 80 cc. of acetic acid and 400 cc. of water. Mix thoroughly and add enough water to make 1000 cc. Emulsion of oil of turpentine, *emulsum olei terebinthinae,* U.S.P. Place 5 Gm. of powdered acacia in a dry bottle, add 15 cc. of oil of turpentine, mix thoroughly, add exactly 10 cc. of distilled water, and agitate the mixture briskly until an emulsion forms. Then gradually add enough distilled water to make 100 cc. Dose: 2 cc.

Evidence of Deterioration: Turbidity.
Storage: In tight containers.

OLEIC ACID, *acidum oleicum,* U.S.P.
A pale yellow or brownish-yellow oily liquid, having a peculiar, lard-like odor and taste.
Solubility: Almost insoluble in water, but miscible in all proportions with alcohol, chloroform, ether, benzene and with fixed and volatile oils.
Sp. Gr.: 0.895. Does not congeal above 10° C.
Action and Uses: Reagent in the preparation of medicinal oleates or soaps.
Evidence of Deterioration: When exposed to air, it absorbs oxygen and darkens.
Storage: In tight containers.

OLEORESIN OF ASPIDIUM, *oleoresina aspidii,* U.S.P. (extract of male fern).
A dark green, thick liquid.
Caution: The crystalline deposit which is normally present must be thoroughly mixed with the liquid portion before use.
Solubility: Not less than 85 percent is soluble in purified benzin.
Sp. Gr.: Not less than 1.000.
Action and Uses: Teniacide.
Dosage: Caution! Single dose, once a day, 4 Gm., in capsules or in emulsions.
Storage: In well-closed containers.

OLEOVITAMIN A AND D, *oleovitamina A et D,* U.S.P.
A thin, oily liquid, which may have a fishy, but not rancid, odor and taste.
Solubility: Insoluble in water; slightly soluble in alcohol.
Action and Uses: Used in vitamin A and D deficiencies.
Dosage: 8 cc.
Preparations: Concentrated Oleovitamin A and D Capsules, *capsulae oleovitaminae A et D concentrata,* U.S.P. Dose: 1 capsule.
Evidence of Deterioration: A rancid product.
Storage: In tight containers.

OLIVE OIL, *oleum olivae,* U.S.P. (sweet oil).
A pale yellow or yellowish-green fixed oil.
Solubility: Miscible with ether and chloroform.
Sp. Gr.: 0.912.
Action and Uses: Emollient, protective, laxative, and nutrient; stimulates the gall bladder.
Evidence of Deterioration: Rancidity.
Storage: In tight containers.

OPIUM, *opium,* U.S.P. (gum opium)
Dark brown masses of the dried juice of the opium poppy. It contains 9.5 percent of anhydrous morphine.
Action and Uses: Similar to morphine but is absorbed more slowly. It is ineffective for local external application. Danger of addiction.
Preparations: Powdered opium, *opium pulveratum,* U.S.P., 10 percent anhydrous morphine.
Tincture of opium, *tinctura opii,* U.S.P. (laudanum). 1 percent anhydrous morphine. Dose: 0.6 cc.
Camphorated tincture of opium, *tinctura opii camphorata,* U.S.P. (paregoric, *tinctura opii benzoica,* P.I.) 40 cc. of tincture of opium, 4 cc. of oil of anise, 4 Gm. of benzoic acid, and 4 Gm. of camphor are dissolved in 900 cc. of diluted alcohol. 40 cc. of glycerin and enough diluted alcohol are added to make 1000 cc. Dose: 4 cc.
Powder of ipecac and opium, *pulvis ipecacuanhae et opii,* N.F. (Dover's powder). 10 Gm. of powdered opium, 10 Gm. of ipecac and 80 Gm. of lactose are mixed and triturated until the product is a very fine powder. Dose: 0.3 Gm.
Storage: In well-closed containers.

ORTHOFORM, N.N.R.
A fine, white, crystalline powder.
Solubility: Almost insoluble in water; freely soluble in alcohol.
Action and Uses: Local anesthetic. Seldom used today.
Storage: In well-closed containers.

PAMAQUINE NAPHTHOATE, *pamaquinae naphthoas,* U.S.P. (aminoquin naphthoate)
A yellow to orange yellow, odorless powder, tasteless, or nearly so, and having a local anesthetic effect when placed on the tongue.
Solubility: Insoluble in water; soluble in alcohol and in acetone.
Action and Uses: Antimalarial, less effective and more toxic than quinine and quinacrine.
Dosage: 20 mg.
Storage: In tight, light-resistant containers.

PANTOPON
A mixture of opium alkaloids in the proportions in which they occur in the crude drug. A yellowish-gray crystalline powder.
Solubility: Freely soluble in water.
Incompatibilities: Alkalies precipitate it.
Action and Uses: See opium.
Dosage: 3 to 20 mg.
Preparations: Tablets and ampuls.
Storage: In tight containers.

PARAFFIN, *paraffinum,* N.F.
A colorless or white, more or less translucent mass, showing a crystalline structure. It has no odor or taste, and is slightly greasy to the touch.
Solubility: Insoluble in water and in alcohol. Freely soluble in chloroform, ether, benzene, benzin, and fixed and volatile oils.
Melting Point: 47° to 65° C.
Action and Uses: An ingredient of pharmaceutical preparations.
Storage: In well-closed containers, at a temperature below 40° C.

PARALDEHYDE, *paraldehydum,* U.S.P. (paracetaldehyde)
A colorless liquid having a strong, characteristic odor and taste.
Solubility: Soluble in water (8). It is miscible with alcohol, chloroform, ether, and volatile oils.
Sp. Gr.: 0.990
Action and Uses: Prompt hypnotic and sedative.
Dosage: 4 cc. with ice-cold liquids to increase palatability.
Storage: In well-filled, tight, light-resistant containers at a temperature below 30° C.

PENICILLIN SODIUM
The sodium salt of a bactericidal and spirocheticidal substance produced during the growth of the mold *penicillium notatum.* The calcium salt is also used.
Description: Penicillin sodium is dispensed as a fine powder, and also as granules or scales. It may be white or naturally colored. It is readily soluble in water.
Action and Uses: A drug of low toxicity to the human body, it destroys or inhibits the growth of certain microorganisms and so shortens the disease in many staphylococcic and streptococcic infections, syphilis, gonorrhea, and in various other conditions such as pneumonia, osteomyelitis, and meningitis when these are caused by microorganisms susceptible to the drug.
Dosage: 100,000 Oxford units in 24 hours. The drug is given intravenously dissolved in physiological salt solution. For intramuscular administration the drug is dissolved in physiological salt solution, and a local anesthetic is often added. The drug may be used locally in the treatment of infected wounds, or in the irrigation of infected body cavities. The drug is too irritating for subcutaneous administration.
Storage: In hermetic glass containers at a temperature not above 10° C.

PENTOBARBITAL SODIUM, *pentobarbitalum sodicum,* U.S.P. (soluble pentobarbital)
White, crystalline granules or a white powder.
Solubility: Very soluble in water; freely soluble in alcohol.
Incompatibilities: Acids decompose it, precipitating pentobarbital.
Action and Uses: Hypnotic and sedative.
Dosage: 0.1 Gm.

Preparations: Pentobarbital sodium capsules, *capsulae pentobarbitali sodici,* U.S.P. Dose: 0.1 Gm.

Pentobarbital sodium tablets, *tabellae pentobarbitali sodici,* U.S.P. Dose: 0.1 Gm.

Storage: In tight containers.

PENTOTHAL SODIUM, N.N.R.

A yellowish-white, hygroscopic powder with a sulfur-like odor.

Solubility: Soluble in water and in alcohol, insoluble in absolute ether and in benzene.

Incompatibilities: Acids decompose it.

Action and Uses: A powerful, brief acting barbiturate. It is used in intravenous injection to produce a general anesthesia of short duration.

Dosage: 2 to 3 cc. of a 5 percent solution, injected in about 10 or 15 seconds. This may be repeated.

Evidence of Deterioration: Aqueous solutions of pentothal sodium are not stable; on boiling the solution, a precipitation occurs.

Storage: In tight containers.

PERUVIAN BALSAM, *balsamum Peruvianum,* U.S.P. (balsam of Peru, Peru balsam)

A dark brown, viscid liquid with an odor resembling vanilla, and having a bitter, acrid taste. It does not harden on exposure to air.

Solubility: Nearly insoluble in water. Soluble in alcohol and in chloroform with not more than an opalescence.

Sp. Gr.: 1.16.

Incompatibilities: Peruvian balsam frequently separates in ointments in which it has been incorporated unless it has been mixed with an equal quantity of castor oil or solid petroxolin and the mixture added as the final step in the preparation of the ointment.

Action and Uses: Used externally in the form of ointments or alcoholic solutions as a stimulant to indolent wounds and ulcers and in the treatment of scabies.

Storage: In tight containers, avoiding exposure to excessive heat.

PETROLATUM, *petrolatum,* U.S.P. (petroleum jelly, paraffinum molle)

A light amber, slightly fluorescent, unctuous, semisolid mixture of hydrocarbons.

Solubility: Insoluble in water and in alcohol. A maximum of about 7 percent of an aqueous solution may be incorporated with it.

Melting Point: Between 38° and 60° C.

Incompatibilities: Peruvian balsam does not mix with it satisfactorily. A small quantity of alcohol, castor oil, or solid petroxolin will overcome the difficulty.

Action and Uses: Protective and emollient. Used commonly as the base of ointments.

Preparations: Yellow ointment, *unguentum flavum,* U.S.P. 5 Gm. of wool fat, 5 Gm. of yellow wax and 90 Gm. of petrolatum, melted and mixed.

Storage: In well-closed containers.

PETROLATUM, LIQUID, *petrolatum liquidum,* U.S.P. (liquid paraffin, white mineral oil, heavy liquid petrolatum)

A colorless, odorless, tasteless, oily liquid.

Solubility: Insoluble in water and in alcohol. Miscible with fixed oils except castor oil.

Sp. Gr.: 0.960 to 0.905. Viscosity: 38.1 centistokes at 37.8° C.

Action and Uses: Protective emollient, intestinal lubricant, laxative.

Dosage: 15 cc.

Preparations: Emulsion of liquid petrolatum, *emulsum petrolati liquidi,* U.S.P. (mineral oil emulsion). 500 cc. of liquid petrolatum is emulsified with 125 Gm. of powdered acacia, and 100 cc. of syrup is added. 0.04 Gm. of vanillin is dissolved in 60 cc. of alcohol and this solution, and enough water to make 1000 cc. are added. Dose: 30 cc.

Storage: In well-closed containers.

PETROLATUM, LIQUID, LIGHT, *petrolatum liquidum leve,* U.S.P. (light liquid paraffin, light white mineral oil).

A colorless, odorless, tasteless, oily liquid.

Solubility: Insoluble in water and in alcohol. Dissolves camphor, menthol, thymol and similar substances, but dissolves phenol only to a very slight extent.

Sp. Gr.: 0.828 to 0.880. Viscosity: 37 centistokes at 37.8° C.

Action and Uses: Emollient. A vehicle of nasal sprays.

Preparations: Aromatic spray, *nebula aromatica,* N.F. 2 Gm. of phenol, 2 Gm. of menthol, 1 Gm. of thymol, 3 Gm. of camphor, 3 Gm. of benzoic acid, 2 cc. of oil of cinnamon, 2 cc. of eucalyptol, 2 cc. of oil of clove and 5 cc. of methyl salicylate are dissolved in enough light liquid petrolatum to make 1000 cc. *Liquid Petroxolin,*

petroxolinum liquidum, N.F. Mix 580 cc. of light liquid petrolatum with 300 cc. of oleic acid and add 500 cc. of strong solution of ammonia previously mixed with 60 cc. of alcohol. Agitate the product until it is clear, warming if necessary. Finally add 5 cc. of oil of lavender and enough alcohol to make 1000 cc. *Solid Petroxolin, petroxolinum spissum,* N.F. Melt 35 Gm. of yellow wax with 20 Gm. of light liquid petrolatum on a water bath. Add 32 Gm. of oleic acid. When mixture is nearly congealed, add 5 cc. of alcohol and 6 cc. of stronger solution of ammonia, previously warmed. Finally incorporate 3 cc. of oil of lavender.

Storage: In well-closed containers.

PHENOBARBITAL, *phenobarbitalum,* U.S.P. (phenylethylmalonylurea)

Small, white crystals or powder.

Solubility: Slightly soluble in water (1000), soluble in alcohol (10).

Action and Uses: Hypnotic, sedative, anticonvulsant, used especially in epilepsy.

Dosage: 0.03 Gm.

Preparations: Elixir of phenobarbital, *elixir phenobarbitali,* U.S.P. Dissolve 4 Gm. of phenobarbital in 175 cc. of alcohol, add 30 cc. of tincture of sweet orange peel, 100 cc. of glycerin, 10 cc. of solution of amaranth and enough distilled water to make 700 cc. Dissolve 400 Gm. of sucrose in this solution and add enough distilled water to make 1000 cc. Dose: 4 cc.

Tablets of phenobarbital, *tabellae phenobarbitali,* U.S.P. 0.015 Gm., 0.030 Gm., and 0.100 Gm., usually available.

Storage: In well-closed containers.

PHENOL, *phenol,* U.S.P. (Carbolic Acid)

Colorless or pinkish-white crystals or crystalline masses.

Caution: Avoid contact with the skin; it is caustic.

Solubility: Soluble in water (15); very soluble in alcohol, in glycerin and in fixed and volatile oils.

Incompatibilities: It separates from aqueous solutions of concentrations from about 5 to 90 percent; glycerin may be employed to prevent this separation.

Action and Uses: Antiseptic, germicide, caustic, local anesthetic and antipruritic. Not used internally.

Preparations: Phenolated water, *aqua phenolata,* N.F. (solutio phenoli, P.I.). 22 cc. of liquefied phenol is mixed with enough distilled water to make 1000 cc.

Glycerite of phenol, *glyceritum phenolis,* N.F. 20 cc. liquefied phenol is mixed with 79 cc. of glycerin. 1 Gm. of sodium citrate is dissolved in 1 cc. of hot distilled water and the solution added to the mixture.

Phenolated oil, *oleum phenolatum,* N.F. 5 Gm. of phenol is melted and dissolved in enough olive oil to make 100 cc.

Liquefied phenol, *phenol liquefactum,* U.S.P. Phenol is melted and for each 9 Gm. of it, 1 cc. of distilled water is added. The product is a clear liquid.

Phenol ointment, *unguentum phenolis,* U.S.P. (carbolic salve). 2 Gm. of phenol is incorporated with 98 Gm. of yellow ointment.

Storage: In tight, light-resistant containers.

PHENOLPHTHALEIN, *phenolphthaleinum,* U.S.P.

A white, odorless, tasteless powder.

Solubility: Insoluble in water; soluble in alcohol (15) and in ether (75).

Incompatibilities: It is colored red by alkalies.

Action and Uses: Cathartic. In solution it is used as a chemical indicator and to color products such as magnesia magma.

Dosage: 0.060 Gm.

Preparations: Tablets of phenolphthalein, *tabellae phenolphthaleini,* N.F., 0.06 Gm.

Storage: In well-closed containers.

PHENOLSULFONPHTHALEIN, *phenolsulfonphthaleinum,* U.S.P. (phenol red)

A red, crystalline powder.

Solubility: Slightly soluble in water (1300) and in alcohol (350).

Action and Uses: Used for determining the functional activity of the kidney.

Dosage: 0.006 Gm., intramuscularly or intravenously.

Preparations: Phenolsulfonphthalein injection, *injectio phenolsulfonphthaleini,* U.S.P. A sterile, isotonic solution of phenolsulfonphthalein dissolved with the aid of sodium bicarbonate or sodium hydroxide.

Storage: In well-closed containers.

PHENYL SALICYLATE, *phenylis salicylas,* U.S.P. (Salol)

A white, crystalline powder, having a characteristic odor and taste.

Solubility: Very slightly soluble in water (6700); in alcohol (6). It is very soluble in chloroform, in ether, and in fixed and volatile oils.
Melting Point: 42° C.
Action and Uses: Formerly used as an antipyretic and antiseptic.
Dosage: 0.3 Gm.
Preparations: Tablets of phenyl salicylate, *tabellae phenylis salicylatis,* N.F. Dose: 0.3 Gm.
Storage: In tight containers, at a temperature not above 35° C.

PHOSPHORIC ACID, *acidum phosphoricum,* U.S.P.
A colorless, odorless, syrupy liquid containing about 86.5 percent H_3PO_4.
Solubility: Miscible with water and with alcohol.
Sp. Gr.: 1.71
Incompatibilities: It has the usual incompatibilities of strong acids. Soluble salts of calcium, lead, silver and ferric iron are precipitated by it.
Action and Uses: In the diluted form, as an acidulous flavor.
Preparations: Diluted phosphoric acid, *acidum phosphoricum dilutum,* U.S.P. Prepared by diluting 69 cc. of phosphoric acid with sufficient distilled water to make 1000 cc.
Dose: 1 cc.
Storage: In tight containers.

PHYSOSTIGMINE SALICYLATE, *physostigminae salicylas,* U.S.P. (eserine salicylate) White or faintly yellow, shining, odorless crystals. It acquires a red tint when long exposed to light and air.
Caution: It is extremely poisonous.
Solubility: Soluble in water (75), in alcohol (16), in chloroform (6), and in ether (250).
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: It is used as a miotic, in the treatment of abdominal distention, and in myasthenia gravis.
Dosage: 2 mg.; for the eye, 0.1 to 1 percent solutions.
Evidence of Deterioration: A product having a color darker than a faint yellow.
Storage: In tight, light-resistant containers, which hold not more than 1 Gm.

PILOCARPINE HYDROCHLORIDE, *pilocarpinae hydrochloridum,* N.F.
Colorless, translucent, hygroscopic crystals.
Solubility: Soluble in water (0.3) and in alcohol (3).
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Parasympathomimetic drug, formerly employed to stimulate sweating but not used for this purpose in modern medicine. Dilute solutions applied to eye cause miosis.
Dosage: 5 mg; 0.5–1.0 percent solution in eye.
Storage: In tight containers, protected from light.

PINE TAR, *pix pini,* U.S.P. *(pix liquida)*
A viscid, brownish-black liquid.
Solubility: Slightly soluble in water; soluble in alcohol.
Action and Uses: Antiseptic used in chronic diseases of the skin, usually in the form of an ointment. Internally it was formerly used as an irritant expectorant.
Preparations: Pine tar ointment, *unguentum picis pini,* U.S.P. Equal parts of pine tar and yellow ointment.
Storage: In well-closed containers.

PITRESSIN, N.N.R.
An aqueous solution which contains the pressor and diuretic-antidiuretic principle of the posterior lobe of the pituitary gland.
Action and Uses: Used to increase muscular activity of the bladder and intestinal tract, and to produce antidiuretic effect in diabetes insipidus.
Dosage: Intramuscular or subcutaneous, 0.3 to 1 cc.
Preparations: Ampuls.
Storage: In hermetic containers.

PLAGUE BACILLUS VACCINE, N.N.R.
A vaccine prepared from killed *Pasteurella pestis.*
Action and Uses: Used in the prevention of plague.
Dosage: Ordinarily administered subcutaneously in two doses containing 1,000 million and 2,000 million killed bacilli, respectively.
Storage: In hermetic containers, at a temperature between 2° and 10° C.

POISON IVY EXTRACT, N.N.R.
A solution of a resin extracted from the fresh leaves of poison ivy.
Action and Uses: Used for prevention or treatment of the symptoms of the dermatitis produced through contact with poison ivy.
Dosage: Intramuscular, 0.5 to 1 cc.
Storage: In hermetic containers.

POISON OAK EXTRACT, N.N.R.
A solution of a resin extracted from the leaves of poison oak.
Action and Uses: Used for the prevention and treatment of the symptoms of the dermatitis produced through contact with poison oak.
Dosage: Intramuscular, 0.7 to 1 cc.
Storage: In hermetic containers.

POSTERIOR PITUITARY INJECTION, *injectio pituitarii posterioris,* U.S.P.
(Solution of posterior pituitary, solution of pituitary)
A clear or only faintly opalescent liquid, colorless, or nearly so, and having a faint, characteristic odor.
Action and Uses: Used to contract smooth muscle, as in postpartum hemorrhage, and in postoperative distention.
Dosage: Intramuscular, 1 cc.
Storage: In hermetic containers, protected from light.

POTASSIUM ACETATE, *potassii acetas,* U.S.P.
Colorless, monoclinic crystals or a white, crystalline powder. It is deliquescent on exposure to moist air.
Solubility: Soluble in water (0.5) and in alcohol (3).
Action and Uses: Systemic alkali and diuretic.
Dosage: 1 Gm.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

POTASSIUM BICARBONATE, *potassii bicarbonas,* U.S.P.
Colorless, transparent, monoclinic prisms or a white, granular powder.
It is stable in air.
Solubility: Soluble in water (2.8); almost insoluble in alcohol.
Incompatibilities: Acids decompose it with evolution of carbon dioxide.
Action and Uses: Antacid reagent.
Dosage: 1 Gm.
Storage: In well-closed containers.

POTASSIUM BROMIDE, *potassii bromidum,* U.S.P.
White, odorless, cubical crystals or a granular powder. It is stable in air.
Solubility: Soluble in water (1.5), in alcohol (250), and in glycerin (5).
Action and Uses: Sedative.
Dosage: 1 Gm.
Preparation: Elixir of potassium bromide, *elixir potassii bromidi,* N.F. Dissolve 175 Gm. of potassium bromide in 460 cc. of distilled water, add 200 cc. of syrup and sufficient aromatic elixir to make 1000 cc. Filter. Dose: 4 cc.
Storage: In well-closed containers.

POTASSIUM CARBONATE, *potassii carbonas,* U.S.P.
A white, granular powder, odorless, and very deliquescent.
Solubility: Soluble in water (1) and insoluble in alcohol.
Incompatibilities: Acids decompose it with the evolution of carbon dioxide.
Action and Uses: Used chiefly as a reagent. Occasionally in ointments.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

POTASSIUM CHLORATE, *potassii chloras,* N.F.
Colorless, odorless, lustrous, monoclinic prisms or plates, or a white, granular powder. It is stable in air.
Caution: Great caution should be observed in handling this salt, as dangerous explosions are likely to occur when it is heated or subjected to concussion or to trituration with organic substances, such as cork, tannic acid, dust, sucrose, etc., or with charcoal, sulfur, sulfides, hypophosphites, reduced iron, or other easily oxidizable substances.

Solubility: Slowly soluble in water (16.5), soluble in glycerin, almost insoluble in alcohol.
Incompatibilities: Concentrated acids decompose it with the liberation of chlorine.
Action and Uses: Used chiefly in mouth washes and gargles as an antiseptic and astringent. Its use internally is irrational and rather dangerous.
Dosage: 0.3 Gm.
Preparations: Gargle of potassium chlorate with iron, *gargarisma potassii chloratis cum ferro,* N.F. (golden gargle). Dissolve 15 Gm. of potassium chlorate in a mixture of 240 cc. of glycerin and 600 cc. of distilled water. Add 120 cc. of tincture of ferric chloride and sufficient distilled water to make 1000 cc.
Tablets of potassium chlorate, *tabellae potassii chloratis,* N.F. Dose: 0.3 Gm.
Storage: In well-closed containers.

POTASSIUM CHLORIDE, *potassii chloridum,* U.S.P.
Colorless, elongated, prismatic, or cubical crystals, or a white, granular powder. It is odorless and is permanent in air.
Solubility: Soluble in water (2.8); insoluble in alcohol.
Action and Uses: To supply potassium to the body.
Dosage: 1 Gm.
Preparations: Potassium chloride tablets, *tabellae potassii chloridi,* U.S.P. Dose 1 Gm.
Storage: In well-closed containers.

POTASSIUM HYDROXIDE, *potassii hydroxidum,* U.S.P. (caustic potash, potash lye)—It contains 85 percent KOH.
Dry, white, or nearly white, fused masses, in small pellets, in flakes, in sticks, and in other forms. It rapidly absorbs carbon dioxide and moisture from the air and deliquesces.
Caution: Great caution is necessary in handling potassium hydroxide, as it rapidly destroys organic tissues. In making solutions, use vessels capable of withstanding great heat and stir during the process of solution.
Solubility: Soluble in water (1), in alcohol (3), and in glycerin (2.5).
Action and Uses: Used as an escharotic and as a reagent.
Preparations: Solution of potassium hydroxide, *liquor potassii hydroxidi,* N.F. Dissolve 60 Gm. of potassium hydroxide in sufficient distilled water to make 1000 cc. Dose: 1 cc. (well diluted).
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

POTASSIUM IODIDE, *potassii iodidum,* U.S.P.
Cubical crystals, either transparent and colorless or somewhat opaque and white, or a white, granular powder. It is stable in dry air, but slightly deliquescent in moist air.
Solubility: Soluble in water (0.7), in alcohol (22), and in glycerin (2).
Incompatibilities: Alkaloidal salts may be precipitated by it. Acids may decompose it with the liberation of iodine.
Action and Uses: To supply iodine for the prevention of simple goiter and the treatment of thyrotoxicosis. Its use in tertiary syphilis, and as an expectorant is declining. Reagent.
Preparations: Solution of potassium iodide, *liquor potassii iodidi,* N.F. (saturated solution of potassium iodide). Dissolve 100 Gm. of potassium iodide in 68 cc. of hot distilled water, cool to 25° C. and add sufficient distilled water to make 100 cc. Dose: 0.3 cc. *Note.* If solution of potassium iodide is not to be used extemporaneously, 50 mg. of sodium thiosulfate should be added.
Tablets of potassium iodide, *tabellae potassii iodidi,* N.F. Dose: 0.3 Gm.
Ointment of potassium iodide, *unguentum potassii iodidi,* N.F.
Evidence of Deterioration: A deliquesced or discolored product.
Storage: In tight containers.

POTASSIUM NITRATE, *potassii nitras,* U.S.P. (saltpeter)
Colorless, transparent prisms or a white, crystalline powder. It is odorless and is slightly hygroscopic in moist air.
Solubility: Soluble in water (3) and in alcohol (620).
Action and Uses: Obsolete diuretic, irritant to kidneys and intestines.
Dosage: 1 Gm.
Evidence of Deterioration: A caked product.
Storage: In tight containers.

POTASSIUM PERMANGANATE, *potassii permanganas,* U.S.P.
Dark purple crystals, almost opaque by transmitted light and of a blue, metallic luster by reflected light. It is stable in air.
Caution: Great caution should be observed in handling potassium permanganate, as dangerous explosions are likely to occur if it is brought into contact with organic or other readily oxidizable substances, either in solution or in the dry condition.
Solubility: Soluble in water (15). Solution is facilitated by the use of heat. Decomposed by alcohol and glycerin.
Incompatibilities: Organic matter, in general, decomposes it. In preparing solutions, only distilled water should be used. Solutions stain the skin and fabrics. These stains may be removed by using a dilute solution of sodium bisulfite.
Action and Uses: Effective deodorant, disinfectant and astringent. It is rarely used internally.
Dosage: 0.06 Gm. For application to the skin 1–500 solution; for irrigation and injection 1–10,000 to 1–1000 solutions.
Preparations: Tablets of potassium permanganate, *tabellae potassii permanganatis,* N.F.
Storage: In well-closed containers.

POTASSIUM AND SODIUM TARTRATE, *potassii et sodii tartras,* U.S.P. (Rochelle salt)
Colorless crystals, or a white, crystalline powder. It effloresces slightly in warm, dry air.
Solubility: Soluble in water (1) and practically insoluble in alcohol.
Action and Uses: Saline cathartic.
Dosage: 10 Gm.
Preparations: Compound effervescent powders, *pulveres effervescentes compositi,* U.S.P. (Seidlitz powders, Rochelle powders). The blue paper contains 2.5 Gm. of sodium bicarbonate and 7.5 Gm. of potassium and sodium tartrate. The white paper contains 2.2 Gm. of tartaric acid.
Evidence of Deterioration: A white coating on the crystals.
Storage: In tight containers.

POTASSIUM SULFATE, *potassii sulfas,* N.F.
Hard colorless, translucent, 6-sided, rhombic prisms terminated by pyramids, or white granules or powder. It is permanent in air.
Solubility: Soluble in water (10) and insoluble in alcohol.
Action and Uses: Saline purgative. Seldom used.
Dosage: 1 Gm.
Storage: In well-closed containers.

POTASSIUM THIOCYANATE, *potassii thiocyanas,* N.F. (potassium rhodanate, potassium sulfocyanate)
Colorless, transparent crystals. It is odorless and hygroscopic.
Solubility: Soluble in water (0.5) and in alcohol (12).
Action and Uses: Used in arterial hypertension.
Dosage: 0.3 Gm.
Evidence of Deterioration: A caked product.
Storage: In tight containers, protected from light.

PRECIPITATED CALCIUM CARBONATE, *calcii carbonas praecipitatus,* U.S.P. (precipitated chalk)
A fine, white, microcrystalline powder, without odor or taste.
Solubility: Practically insoluble in water and in alcohol.
Incompatibilities: Acids decompose it with evolution of carbon dioxide.
Action and Uses: Antacid; largely used as a basis for tooth powders.
Dosage: 1 Gm.
Preparations: Dentifrice, *dentifricium,* N.F. (N.F. tooth powder). Triturate 2 Gm. of soluble saccharin, 4 cc. of oil of peppermint, 2 cc. of oil of cinnamon, and 8 cc. of methyl salicylate with 500 Gm. of precipitated calcium carbonate. Mix 50 Gm. of finely powdered hard soap with 435 Gm. of precipitated calcium carbonate. Mix the two powders thoroughly and pass the mixture through a fine sieve.
Tablets of calcium carbonate, *tabellae calcii carbonatis,* N.F., 1 Gm.
Storage: In well-closed containers.

PRECIPITATED SULFUR, *sulfur praecipitatum,* U.S.P.
A very fine, pale yellow, amorphous or microcrystalline powder, without odor or taste.

Solubility: Practically insoluble in water, and nearly insoluble in alcohol. It is soluble in olive oil (100).
Action and Uses: Antiseptic and antiparasitic. Formerly used as a laxative.
Dosage: 4 Gm.
Preparations: Sulfur ointment, *unguentum sulfuris,* U.S.P. Levigate 15 Gm. of precipitated sulfur with 7 Gm. of wool fat, and incorporate the mixture with 78 Gm. of white ointment.
Storage: In well-closed containers.

PREPARED CALAMINE, *calamina praeparata,* N.F.
A pink powder consisting of zinc oxide with a small amount of ferric oxide. It is odorless and almost tasteless.
Solubility: Insoluble in water, but almost completely soluble in mineral acids.
Action and Uses: Protective in skin disorders.
Preparations: Calamine liniment, *linimentum calaminae,* N.F. Mix 80 Gm. of calamine and 80 Gm. of zinc oxide with 500 cc. of olive oil. Add sufficient solution of calcium hydroxide, in divided portions, and with constant agitation, to make 1000 cc.
Calamine lotion, *lotio calaminae,* N.F. Mix 80 Gm. of calamine and 80 Gm. of zinc oxide with 20 cc. of glycerin and 400 cc. of magma of bentonite, the magma having previously been diluted with an equal volume of solution of calcium hydroxide. Finally, add sufficient solution of calcium hydroxide to make 1000 cc.
Phenolated calamine lotion, *lotio calaminae phenolata,* N.F. Mix 10 cc. of liquefied phenol with 990 cc. of calamine lotion.
Calamine ointment, *unguentum calaminae,* N.F. (Turner's cerate). Melt 4 Gm. of yellow wax, 4 Gm. of wool fat, and 75 Gm. of petrolatum together. Mix 17 Gm. of calamine with the prepared base.
Storage: In well-closed containers.

PREPARED CHALK, *creta praeparata,* U.S.P. (drop chalk)
A white to grayish-white, microcrystalline powder, often prepared in cones, and consisting of a native form of calcium carbonate, freed from most of its impurities by elutriation. It is odorless and tasteless.
Caution: This form of calcium carbonate should not be used in preparations intended for dental use.
Solubility: Insoluble in ordinary solvents.
Incompatibilities: Acids dissolve it with the evolution of carbon dioxide.
Action and Uses: Antacid and protective for mucous membranes.
Dosage: 1 Gm.
Preparations: Chalk mixture, *mistura cretae,* U.S.P. Mix 2.5 Gm. of bentonite with 50 cc. of distilled water, using a mechanical mixer. Dilute the magma thus formed with 40 cc. of cinnamon water and add the mixture to 6 Gm. of prepared chalk and 0.03 Gm. of saccharin sodium contained in a mortar. Finally add enough distilled water to make 100 cc.
Compound chalk powder, *pulvis cretae compositus,* U.S.P. Mix 30 Gm. of prepared chalk with 20 Gm. of acacia and 50 Gm. of sucrose and pass the product through a No. 60 sieve.
Storage: In well-closed containers.

PROCAINE HYDROCHLORIDE, *procainae hydrochloridum,* U.S.P. (procaine)
Small, white crystals, or a white, crystalline powder. It is odorless and is stable in air.
Solubility: Soluble in water (1) and in alcohol (30). It is slightly soluble in chloroform, and is almost insoluble in ether.
Incompatibilities: Alkalies precipitate it.
Action and Uses: Local anesthetic, when injected. Solutions of 1 or 2 percent are most commonly employed, but other strengths are preferred for certain purposes.
Preparations: Ampuls of procaine hydrochloride, *ampullae procainae hydrochloridi,* N.F.
Solution of procaine hydrochloride, *liquor procainae hydrochloridi,* N.F.
Storage: In well-closed containers.

PROFLAVINE, N.N.R. (proflavine sulfate)
A reddish-brown, odorless, crystalline powder.
Solubility: Soluble in water and in alcohol, forming brownish solutions which fluoresce on dilution. It is nearly insoluble in ether, in chloroform, in liquid petrolatum and in fixed and volatile oils.
Action and Uses: Antiseptic and bacteriostatic. It is comparatively free from toxic or irritating action on living tissues but is more irritating than acriflavine base.

Dosage: In solutions for treatment of wounds, 1:1000; in irrigations, 1:10,000 to 1:1000. In middle ear suppurations a 1:500 solution in 50 percent alcohol may be used.
Storage: In tight, light-resistant containers. Solutions over a week old should be discarded.

PROPADRINE HYDROCHLORIDE, N.N.R.
A white, crystalline powder, having an odor resembling that of benzoic acid.
Solubility: Freely soluble in water and in alcohol.
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Sympathomimetic drug used chiefly as a local vasoconstrictor for nasal mucous membrane.
Dosage: Oral, 25 mg. For local applications, 0.5 to 1 percent aqueous solutions.
Storage: In well-closed containers.

PUMICE, *pumex,* N.F.
A gritty, grayish powder of volcanic origin, consisting chiefly of complex silicates of aluminum, potassium and sodium.
Caution: For dental purposes, only the grade of pumice known as "pumice flour" or "superfine pumice" should be used.
Solubility: Insoluble in ordinary solvents.
Action and Uses: An abrasive and absorbent.
Storage: In well-closed containers.

PURIFIED TALC, *talcum purificatum,* U.S.P.
A very fine, white or grayish-white, crystalline powder. It is unctuous, adhering readily to the skin, and is free from grittiness.
Solubility: Insoluble in ordinary solvents.
Action and Uses: Used as a dusting powder, and as a diffusing agent.
Storage: In well-closed containers.

QUINACRINE HYDROCHLORIDE, *quinacrinae hydrochloridum,* U.S.P. (mepacrine hydrochloride)
A bright yellow, crystalline powder. It is odorless and has a bitter taste.
Solubility: Soluble in water (35); soluble in alcohol.
Action and Uses: Antimalarial.
Dosage: 0.1 Gm.
Preparations: Quinacrine hydrochloride tablets, *tabellae quinacrinae hydrochloridi,* U.S.P. Dose: 0.1 Gm.
Storage: In tight, light-resistant containers.

QUINIDINE SULFATE, *quinidinae sulfas,* U.S.P.
Fine, needle-like, white crystals, frequently cohering in masses. It is odorless, has a very bitter taste, and darkens on exposure to light.
Solubility: Soluble in water (100) and in alcohol (10). It is soluble in chloroform but almost insoluble in ether.
Incompatibilities: Alkalies precipitate it.
Action and Uses: Antimalarial and in the treatment of cardiac arrhythmia.
Dosage: 0.2 Gm.
Preparations: Quinidine sulfate tablets, *tabellae quinidinae sulfatis,* U.S.P. Dose: 0.2 Gm.
Evidence of Deterioration: Darkening due to exposure to light.
Storage: In well-closed, light-resistant containers.

QUININE DIHYDROCHLORIDE, *quininae dihydrochloridum,* U.S.P.
A white, odorless powder, having a very bitter taste. It is affected by light.
Solubility: Soluble in water (0.6) and in alcohol (12).
Incompatibilities: Alkalies precipitate it.
Action and Uses: Antimalarial.
Dosage: 1 Gm.
Preparations: Ampuls of quinine dihydrochloride, *ampullae quininae dihydrochloridi,* N.F. Dose: 0.5 Gm.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

QUININE SULFATE, *quininae sulfas,* U.S.P.
White, fine, needle-like crystals. It is odorless and has a persistent, very bitter taste. When exposed to light, it acquires a brown tint.

Solubility: Soluble in water (810) and in alcohol (120).
Incompatibilities: A mixture of quinine sulfate and aspirin undergoes partial liquefaction.
Action and Uses: Antimalarial.
Dosage: 0.6 Gm.
Preparations: Quinine sulfate tablets, *tabellae quininae sulfatis,* U.S.P.
Evidence of Deterioration: A product having a brownish tint.
Storage: In well-closed, light-resistant containers.

RECTIFIED OIL OF TAR, *oleum picis rectificatum,* U.S.P.
A dark brown volatile oil.
Solubility: Very soluble in alcohol.
Action and Uses: Antseptic, irritant, and parasiticide for external use. Seldom used internally.
Preparations: Syrup of pine tar, *syrupus picis pini,* U.S.P. (syrup of tar). Mix 1 cc. of rectified oil of tar with 450 cc. of water and agitate it frequently for 15 minutes; set it aside for 24 hours, filter, and dissolve 850 Gm. of sucrose in the filtrate. Add water to make 1000 cc.
Storage: In tight containers.

RESORCINOL, *resorcinol,* U.S.P. (resorcin)
White or nearly white, needle-shaped crystals or powder. It has a faint, characteristic odor and a sweetish, followed by a bitter taste. It acquires a pink tint on exposure to light and air.
Solubility: Soluble in water (1) and in alcohol (1). It is freely soluble in glycerin and in ether, and is slightly soluble in chloroform.
Action and Uses: Irritant, antiseptic; externally, in skin diseases.
Dosage: 0.125 Gm.
Preparations: Strong paste of resorcinol, *pasta resorcinolis fortis,* N.F.
Mild paste of resorcinol, *pasta resorcinolis mitis,* N.F.
Compound ointment of resorcinol, *unguentum resorcinolis compositum,* N.F. Melt 10 Gm. of yellow wax and 28 Gm. of wool fat on a water bath. Levigate 6 Gm. of zinc oxide and 6 Gm. of bismuth subnitrate with 25 Gm. of petrolatum and add to the melted mixture. Dissolve 6 Gm. of resorcinol in 13 Gm. of glycerin and incorporate the solution with the above mixture. Add 6 Gm. of rectified oil of birch tar and stir the product until it congeals.
Evidence of Deterioration: A product having a color darker than brownish-pink.
Storage: In well-closed, light-resistant containers.

RIBOFLAVIN, *riboflavinum,* U.S.P. (lactoflavin, vitamin B_2, vitamin G)
An orange-yellow, crystalline powder, having a slight odor. It is affected by light.
Solubility: Soluble in water (10,000); less soluble in alcohol; insoluble in ether and in chloroform; very soluble in dilute alkalies.
Incompatibilities: In solution, especially in the presence of alkalies, it deteriorates rapidly on exposure to light.
Action and Uses: A vitamin of the "B" group. It is a specific in the treatment of riboflavin deficiency.
Dosage: 5 mg.
Preparations: Riboflavin tablets, *tabellae riboflavini,* U.S.P., 1 mg. and 5 mg.
Storage: In tight, light-resistant containers.

SACCHARIN SODIUM, *saccharinum sodicum,* U.S.P. (soluble saccharin, soluble gluside, sodium benzosulfimide)
White crystals, or a white, crystalline powder. It is odorless, or has a faint, aromatic odor, and an intensely sweet taste, even in dilute solution.
Solubility: Soluble in water (1.5) and in alcohol (50).
Action and Uses: A sweetening agent used as a substitute for sucrose. 30 mg. is the approximate equivalent in sweetening power of 15 Gm. of sucrose.
Preparations: Saccharin sodium tablets, *tabellae saccharini sodici,* U.S.P., 15 mg., 30 mg., and 60 mg.
Storage: In well-closed containers.

SALICYLIC ACID, *acidum salicylicum,* U.S.P.
White crystals in the form of fine needles, or a fluffy, white, crystalline powder. The synthetic variety is white and odorless; that prepared from natural methyl salicylate may have a slightly yellow or pink tint and a faint odor of gaultheria.
Caution: When salicylic acid is to be dissolved, the crystals should be used. Only finely powdered salicylic acid should be used in ointments and dusting powders.

Solubility: Soluble in water (460), in alcohol (3), in chloroform (45), in ether (3), in glycerin (about 60), in fats and oils (about 80).
Incompatibilities: Carbonates and bicarbonates are decomposed by it. With iron compounds, it forms a soluble, purplish-black product.
Action and Uses: Keratolytic, skin antiseptic. Used in the treatment of parasitic and other skin diseases as an ointment; for the removal of corns and callosities in the form of a collodion.
Preparations: Salicylic collodion, *collodium salicylicum,* N.F. Prepared by dissolving 10 Gm. of salicylic acid in sufficient flexible collodion to make 100 cc.
Storage: In well-closed containers.

SANTONIN, *santoninum,* N.F.
Colorless crystals, or a white, crystalline powder. It is stable in the air, but rapidly becomes yellow on exposure to light.
Solubility: Almost insoluble in cold water, and only slightly soluble in boiling water. Soluble in alcohol (45) and in chloroform (2).
Action and Uses: Anthelmintic. When a poisonous dose is absorbed it produces yellow vision and epileptiform convulsions.
Dosage: 0.06 Gm.
Evidence of Deterioration: A yellow product.
Storage: In well-closed containers, protected from light.

SCARLET FEVER STREPTOCOCCUS ANTITOXIN, *antitoxinum scarlatinae streptococcicum,* U.S.P. (scarlet fever antitoxin, refined scarlet fever antitoxin, concentrated scarlet fever antitoxin, anti-scarlet fever globulins).
A sterile, aqueous solution of antitoxic substances obtained from the blood serum or plasma of a healthy animal which has been immunized against the toxin produced by the streptococcus regarded as causative of scarlet fever. It has a potency of not less than 400 antitoxic units per cc.
Action and Uses: Curative and prophylactic in scarlet fever. Its use has declined since the advent of the sulfonamides.
Dosage: By parenteral injection: therapeutic, 6000 units; prophylactic, 2000 units.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit. It must be dispensed in the unopened glass container in which it was placed by the manufacturer.

SCARLET FEVER STREPTOCOCCUS TOXIN, *toxinum scarlatinae streptococcicum,* U.S.P. (scarlet fever streptococcic toxin, scarlet fever toxin for immunization and for the Dick test).
Action and Uses: Used in the Dick test to determine susceptibility to scarlet fever, and also to induce active immunity to scarlet fever.
Dosage: Diagnostic, intracutaneous, 0.1 cc. of the dilution, representing one skin test dose. Prophylactic injection, for active immunization, graded hypodermic doses to be given at proper intervals until a negative Dick test is obtained.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

SCOPOLAMINE HYDROBROMIDE, *scopolaminae hydrobromidum,* U.S.P. (hyoscine hydrobromide).
Colorless or white crystals or a white, granular powder.
Caution: It is extremely poisonous.
Solubility: Soluble in water (1.5); in alcohol (20).
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Peripheral action like atropine, but unlike atropine it is a central sedative. Used as a sedative, especially in conjunction with morphine. It is a mydriatic when dilute solutions are applied locally to the eye.
Dosage: 0.5 mg. 0.5 per cent solution is used in the eyes.
Preparations: Tablets of scopolamine hydrobromide, *tabellae scopolaminae hydrobromidi,* N.F. Dose: 0.6 mg.
Storage: In tight, light-resistant containers.

SECONAL SODIUM, N.N.R
A white, hygroscopic, odorless powder, chemically related to barbital.
Solubility: Very soluble in water; soluble in alcohol.
Incompatibilities: Acids decompose it.
Action and Uses: Hypnotic and sedative.
Dosage: 0.1 Gm.
Storage: In tight containers.

SENNA, *senna,* U.S.P. (senna leaves)
Dried leaflets.
Action and Uses: Cathartic.
Dosage: 2 Gm.
Preparations: Fluidextract of senna, *fluidextractum sennae,* U.S.P. Dose: 2 cc. Compound powder of senna, *pulvis sennae compositus,* N.F. (compound licorice powder)
Senna, 180 Gm., glycyrrhiza, 236 Gm., washed sulfur, 80 Gm., oil of fennel, 4 Gm., and sucrose, 500 Gm. Dose: 4 Gm.
Syrup of senna, *syrupus sennae,* U.S.P. Mix 5 cc. of oil of coriander with 250 cc. of fluidextract of senna, and add 330 cc. of distilled water. Allow the mixture to stand for 24 hours in a cool place, with occasional agitation, then filter, and pass enough distilled water through the filter to obtain 580 cc. of filtrate. Dissolve 635 Gm. of sucrose in this liquid, and add sufficient distilled water to make 1000 cc. Dose: 8 cc.
Storage: In well-closed containers.

SILVER NITRATE, *argenti nitras,* U.S.P.
Colorless or white crystals which, on exposure to light in the presence of organic matter, become gray or grayish-black.
Caution: In the presence of moisture, it rapidly attacks tissues producing a black deposit of silver oxide.
Solubility: Soluble in water (0.4), in alcohol (30).
Incompatibilities: Chlorides precipitate silver chloride. Organic matter, in general, reduces silver nitrate to the oxide.
Action and Uses: Externally as a caustic, antiseptic, and germicide; as a 1 or 2 percent solution it is used to prevent gonorrheal ophthalmia in the new born.
Dosage: 0.010 Gm. For local application, 0.01 to 10 percent aqueous solution, depending upon the site of application. Distilled water should be used in preparing aqueous solutions.
Preparations: Toughened silver nitrate, *argenti nitras induratus,* U.S.P. (moulded silver nitrate, fused silver nitrate, silver nitrate pencils, lunar caustic). Silver nitrate toughened by the addition of a small proportion of silver chloride. It occurs as white pencils or cones which are often coated with wax. The coating of wax must be removed before moistening the pencil for local application.
Evidence of Deterioration: Gray or grayish-black crystals.
Storage: In tight, light-resistant containers.

SILVER PROTEIN, MILD, *argentum proteinicum mite,* U.S.P. (mild silver protein, mild protargin)
Dark brown or almost black, shining scales or granules. It is odorless, is frequently hygroscopic, and is affected by light. It contains about 21 percent of silver.
Caution: Solutions of mild silver protein should be freshly prepared and should be dispensed in amber-colored bottles. Prolonged or indiscriminate use may produce argyria.
Solubility: Freely soluble in water, but almost insoluble in alcohol, in chloroform, and in ether.
Action and Uses: Antiseptic and demulcent. Used in 5 to 40 percent aqueous solutions for application to mucous membranes.
Evidence of Deterioration: Deteriorated solutions contain a variable amount of precipitate.
Storage: In tight, light-resistant containers.

SILVER PROTEIN, STRONG, *argentum proteinicum forte,* U.S.P. (strong silver protein, strong protargin).
A brown, odorless powder. It is usually somewhat hygroscopic and is affected by light. It contains about 8 percent of silver.
Caution: Solutions of strong silver protein should be freshly prepared, and should be dispensed in amber-colored bottles. Prolonged or indiscriminate use may produce argyria.
Solubility: Freely soluble in water but almost insoluble in alcohol, in chloroform, and in ether.
Incompatibilities: Chlorides cause a variable amount of precipitation of silver chloride.
Action and Uses: Antiseptic, germicide, astringent. Used as a mild antiseptic in 0.25 to 10 percent aqueous solution for application to mucous membranes.
Dosage: 0.2 Gm.
Evidence of Deterioration: Darkening on exposure to light.
Storage: In tight, light-resistant containers.

SKIODAN, N.N.R. (skiodan sodium, methiodal)
A white, crystalline, odorless powder, containing iodine.
Solubility: Soluble in water, very soluble in alcohol, slightly soluble in methyl alcohol.
Action and Uses: Used in roentgen ray examination of the urinary tract.
Dosage: Intravenous urography, 2 Gm. in sterile aqueous solution.
Preparations: Tablets; sterile solution, 40 percent.
Storage: In tight, light-resistant containers.

SMALLPOX VACCINE, *vaccinum variolae,* U.S.P. (virus vaccinicum, glycerinated vaccine virus, Jennerian vaccine, anti-smallpox vaccine)
Action and Uses: Prophylactic vaccination against smallpox.
Storage: It must be kept at a very low temperature, preferably below 0° C., and never above 5° C.

SOAP, HARD, *sapo durus,* U.S.P. (Soap)
A soda soap. A white or whitish solid in the form of bars, hard, yet easily cut when fresh, or a fine, white or yellowish-white powder. It has a faint odor, free from rancidity.
Solubility: Slowly soluble in water and in alcohol.
Incompatibilities: Acids decompose it liberating fatty acids.
Action and Uses: Detergent and an ingredient of pharmaceutical preparations.
Preparations: Camphor and soap liniment, *linimentum camphorae et saponis,* U.S.P. (soap liniment)
Dissolve 45 Gm. of camphor and 10 cc. of oil of rosemary in 700 cc. of alcohol, add 60 Gm. of granulated or powdered hard soap, and sufficient distilled water to make 1000 cc. Agitate the mixture until the soap is dissolved, set it aside in a cool place for 24 hours and filter.
Storage: In well-closed containers.

SOAP, SOFT, MEDICINAL, *sapo mollis medicinalis,* U.S.P. (soft soap, green soap)
A soft, unctuous, yellowish-white to brownish- or greenish-yellow, transparent to translucent mass. It has a slight, characteristic odor, and an alkaline taste.
Solubility: Soluble in water and in alcohol.
Incompatibilities: Acids decompose it, liberating fatty acids.
Action and Uses: Detergent and an ingredient of pharmaceutical preparations.
Preparations: Liniment of soft soap, *linimentum saponis mollis,* U.S.P. (tincture of green soap) Mix 20 cc. of oil of lavender with 300 cc. of alcohol, dissolve in this 650 Gm. of medicinal soft soap and set the solution aside for 24 hours. Then filter through paper, adding sufficient alcohol to make 1000 cc.
Evidence of Deterioration: An opaque crust, caused by evaporation of water.
Storage: In well-closed containers.

SOBISMINOL SOLUTION, N.N.R.
A clear, dark brown-red liquid. A complex organic bismuth compound.
Action and Uses: Antisyphilitic.
Dosage: Intramuscular, 2 cc.
Storage: In hermetic containers.

SODIUM ALURATE, N.N.R.
A white, microcrystalline, hygroscopic powder, chemically related to barbital.
Solubility: Very soluble in water; very slightly soluble in alcohol.
Incompatibilities: Acids decompose it.
Action and Uses: Action like barbital but is more powerful. Used as a hypnotic and sedative.
Dosage: 0.065 Gm. for each 7 kilos of body weight.
Storage: In tight containers.

SODIUM BENZOATE, *sodii benzoas,* U.S.P.
A white, odorless, or nearly odorless, granular or crystalline powder. It is stable in air.
Solubility: Soluble in water (2) and in alcohol (75).
Action and Uses: Mild antiseptic, used chiefly as a preservative.
Dosage: 1 Gm.
Storage: In well-closed containers.

SODIUM BICARBONATE, *sodii bicarbonas,* U.S.P. (baking soda)
A white, crystalline powder. It is stable in dry air, but slowly decomposes in moist air.

Solubility: Soluble in water (10); insoluble in alcohol.
Incompatibilities: Acids decompose it with the evolution of carbon dioxide.
Action and Uses: Antacid and mild alkali.
Dosage: 2 Gm.
Preparations: Tablets of sodium bicarbonate, *tabellae sodii bicarbonatis,* U.S.P.
Evidence of Deterioration: A caked product.
Storage: In well-closed containers.

SODIUM BORATE, *sodii boras,* U.S.P. (borax, sodium biborate, sodium tetraborate)
Colorless, transparent crystals, or a white, crystalline powder. It effloresces in warm, dry air, the crystals becoming coated with a white powder.
Solubility: Soluble in water (16) and in glycerin (1); insoluble in alcohol.
Incompatibilities: Alkaloids and salts of the heavy metals are precipitated by it.
Action and Uses: Antiseptic, detergent, and a reagent in pharmaceutical preparations.
Preparations: Compound solution of sodium borate, *liquor sodii boratis compositus,* N.F. (Dobell's solution).
Dissolve 15 Gm. of sodium borate and 15 Gm. of sodium bicarbonate in 500 cc. of distilled water; add 35 cc. of glycerin and 3 cc. of liquefied phenol. Allow the mixture to stand for half an hour; add sufficient distilled water to make 1000 cc. and filter.
Evidence of Deterioration: A white coating on the crystals.
Storage: In well-closed containers.

SODIUM BROMIDE, *sodii bromidum,* U.S.P.
White, odorless, cubical crystals, or a white, granular powder. It absorbs moisture from the air without deliquescing.
Solubility: Soluble in water (1.2) and in alcohol (10).
Incompatibilities: Acids may decompose it, liberating bromine.
Action and Uses: Sedative and cerebral depressant.
Dosage: 1 Gm.
Preparations: Elixir of sodium bromide, *elixir sodii bromidi,* N.F. Dissolve 175 Gm. of sodium bromide in 460 cc. of distilled water, add 200 cc. of syrup and sufficient aromatic elixir to make 1000 cc. Filter. Dose: 4 cc.
Tablets of sodium bromide, *tabellae sodii bromidi,* N.F.
Evidence of Deterioration: A caked product.
Storage: In tight containers.

SODIUM CACODYLATE, *sodii cacodylas,* U.S.P.
White crystals, or a white, granular powder, containing arsenic. It is odorless and deliquescent.
Solubility: Soluble in water (0.5) and in alcohol (2.5).
Action and Uses: Supposed hematinic. Formerly used by hypodermic injection in anemias.
Dosage: 0.06 Gm.
Preparations: Ampuls of sodium cacodylate, *ampullae sodii cacodylatis,* N.F.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

SODIUM CARBONATE, MONOHYDRATED, *sodii carbonas monohydratus,* U.S.P.
Colorless crystals, or a white crystalline powder. It effloresces in warm, dry air.
Solubility: Soluble in water (3).
Incompatibilities: Acids decompose it with liberation of carbon dioxide.
Action and Uses: Alkali, detergent, and a reagent in pharmaceutical preparations.
Evidence of Deterioration: An efflorescent product.
Storage: In tight containers.

SODIUM CHLORIDE, *sodii chloridum,* U.S.P. (Salt)
Colorless, cubical crystals, or a white, crystalline powder.
Action and Uses: Used for adjusting the tonicity of solutions, and to supply Na and Cl when, due to abnormal loss of fluids, the body lacks these essential elements.
Solubility: Soluble in water (2.8); slightly soluble in alcohol.
Preparations: Isotonic solution of sodium chloride, *liquor sodii chloridi isotonicus,* U.S.P.
(Normal saline solution, physiological salt solution)
A 0.9 percent solution of sodium chloride in distilled water.
Isotonic solution of three chlorides, *liquor chloridorum trium isotonicus,* U.S.P. (Ringer's Solution).
Sodium chloride, 8.6 Gm., potassium chloride, 0.30 Gm., calcium chloride, 0.33 Gm., distilled water, recently boiled, sufficient to make 1000 cc.

Evidence of Deterioration: A caked product.
Storage: In tight containers.

SODIUM CITRATE, *sodii citras,* U.S.P.
Colorless crystals, or a white, crystalline powder.
Solubility: Soluble in water (1.5); insoluble in alcohol.
Action and Uses: Systemic alkali and diuretic. Used in the transfusion of blood, as an anticoagulant.
Dosage: 1 Gm.
Preparations: Solution of sodium citrate, *liquor sodii citratis,* N.F. (*mistura sodii citratis, potio riverii*) Dissolve 2 Gm. of citric acid in 100 cc. of distilled water, add 2.5 Gm. of sodium bicarbonate cautiously, dissolve by gentle agitation and immediately stopper the container securely. Dose: 15 cc.
Note. This solution must be freshly prepared.
Anticoagulant solution of sodium citrate, *liquor sodii citratis anticoagulans,* U.S.P.
Storage: In tight containers.

SODIUM HYDROXIDE, *sodii hydroxidum,* U.S.P. (caustic soda). It contains 95 percent NaOH.
White, or nearly white, fused masses, in pellets, in flakes, in sticks, and in other forms. When exposed to the air, it rapidly absorbs carbon dioxide and moisture.
Caution: Great care is necessary in handling sodium hydroxide, as it rapidly destroys organic tissues.
Solubility: Soluble in water (1), and freely soluble in alcohol. Solutions should be prepared in vessels capable of withstanding great heat.
Incompatibilities: It is incompatible with acids and alkaloids.
Action and Uses: Caustic.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

SODIUM INDIGOTINDISULFONATE, *sodii indigotindisulfonas* (indigo carmine, soluble indigo blue)
A dark blue powder.
Solubility: Sparingly soluble in water; almost insoluble in alcohol.
Incompatibilities: The color is discharged by oxidizing agents.
Action and Uses: Used in tests for kidney function. It is used as a dye in poison tablets of mercury bichloride.
Storage: In well-closed containers.

SODIUM IODIDE, *sodii iodidum,* U.S.P.
Colorless crystals, or a white, crystalline powder. In moist air, it cakes and then deliquesces, and frequently undergoes decomposition, developing a brown tint.
Solubility: Soluble in water (0.6), in alcohol (2), and in glycerin (1).
Incompatibilities: Acids may decompose it with the liberation of iodine.
Action and Uses: Expectorant. A source of iodine for the prevention of goiter and the treatment of hyperthyroidism.
Dosage: 0.3 Gm.
Preparations: Ampuls of sodium iodide, *ampullae sodii iodidi,* N.F.
Evidence of Deterioration: A deliquesced product frequently having a brownish tint.
Storage: In tight containers.

SODIUM *r*-LACTATE, One-Sixth Molar, N.N.R.
A clear, colorless, odorless liquid.
Action and Uses: Used in the treatment of acidosis and for the purpose of alkalizing the urine. This solution is isotonic with blood and suitable for intravenous injection.
Storage: In hermetic containers.

SODIUM MORRHUATE, N.N.R.
A pale yellow, granular powder, having a slight, fishy odor.
Solubility: Soluble in water.
Action and Uses: With the addition of a local anesthetic, it is employed in solution as a sclerosing agent for the obliteration of varicose veins.
Dosage: 0.5 to 1 cc. of a 5 percent solution.
Storage: In tight containers.

SODIUM NITRITE, *sodii nitris,* U.S.P.
A white to slightly yellow, granular powder or white, or nearly white, opaque, fused masses or sticks. It is deliquescent.

Solubility: Soluble in water (1.5); sparingly soluble in alcohol.
Incompatibilities: Acids decompose it, liberating oxides of nitrogen.
Action and Uses: Vasodilator.
Dosage: 0.06 Gm.
Preparations: Sodium nitrite tablets, *tabellae sodii nitritis,* U.S.P.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

SODIUM PERBORATE, *sodii perboras,* U.S.P.
White, crystalline granules, or a white powder. It is stable in cool, dry air, but is decomposed with the evolution of oxygen in warm or in moist air. In aqueous solution, it decomposes into sodium metaborate and hydrogen peroxide, the solution gradually evolving oxygen.
Solubility: Soluble in water(40).
Action and Uses: Oxidizer, local bactericide.
Preparations: Aromatic sodium perborate, *sodii perboratis aromaticus,* N.F. Triturate 4 cc. of oil of peppermint and 4 Gm. of soluble saccharin with enough sodium perborate to make 1000 Gm.
Storage: In tight containers, at a temperature not above 30° C.

SODIUM PHOSPHATE, *sodii phosphas,* U.S.P.
A colorless or white, granular salt. It is efflorescent.
Solubility: Soluble in water (4); very slightly soluble in alcohol.
Action and Uses: Saline cathartic.
Dosage: 4 Gm.
Preparations: Solution of sodium phosphate, *liquor sodii phosphatis,* N.F. Dose: 8 cc.
Effervescent sodium phosphate, *sodii phosphas effervescens,* U.S.P. Dose: 10 Gm.
Exsiccated sodium phosphate, *sodii phosphas exsiccatus,* U.S.P. (dried sodium phosphate). Dose: 2 Gm.
Evidence of deterioration: A white coating on the crystals or granules.
Storage: In tight containers.

SODIUM SALICYLATE, *sodii salicylas,* U.S.P.
White, microcrystalline powder, or scales, or an amorphous powder. It is colorless or not more than a very faint pink. It is odorless or has a faint, characteristic odor.
Solubility: Soluble in water (1), in alcohol (10), and in glycerin (4).
Incompatibilities: With ferric compounds, it forms a purplish-black, soluble compound.
Action and Uses: Antirheumatic, antipyretic, analgesic. Used especially in acute rheumatic fever.
Dosage: 0.3 Gm.
Preparations: Ampuls of sodium salicylate, *ampullae sodii salicylatis,* N.F.
Sodium salicylate tablets, *tabellae sodii salicylatis,* U.S.P.
Storage: In well-closed, light-resistant containers.

SODIUM SULFATE, *sodii sulfas,* U.S.P. (Glauber's salt)
Large, colorless, odorless, transparent crystals, or a granular powder. It is efflorescent. It liquefies in its water of hydration at about 33° C.
Solubility: Soluble in water (1.5) and in glycerin, insoluble in alcohol.
Action and Uses: Saline cathartic.
Dosage: 15 Gm.
Evidence of Deterioration: An effloresced product or a liquefied product.
Storage: In tight containers, at a temperature not above 30° C.

SODIUM THIOSULFATE, *sodii thiosulfas,* U.S.P. ("sodium hyposulfite," "hypo").
Large, colorless crystals or a coarse, crystalline powder. It is deliquescent in moist air; it effloresces in dry air at a temperature above 33° C.
Solubility: Soluble in water (0.5); insoluble in alcohol.
Incompatibilities: Acids decompose it, precipitating sulfur.
Action and Uses: Antiseptic, germicide, antipruritic. Formerly used as an antidote for some metallic poisons.
Dosage: Oral or intravenous, 1 Gm.
Preparations: Ampuls of sodium thiosulfate, *ampullae sodii thiosulfatis,* N.F.
Evidence of Deterioration: A deliquesced or an effloresced product.
Storage: In tight, light-resistant containers.

SOLUBLE FERRIC PHOSPHATE, *ferri phosphas solubilis,* N.F.
Thin, bright green, transparent, odorless scales.

Solubility: Readily in warm water; insoluble in alcohol.
Action and Uses: Formerly used as a hematinic.
Dosage: 0.25 Gm., usually in an elixir.
Preparations: An ingredient of elixir of iron, quinine and strychnine phosphates, N.F.
Evidence of deterioration: Discoloration.
Storage: In tight containers, protected from light.

SOLUTION OF MAGNESIUM CITRATE, *magnesii citratis, liquor,* U.S.P.
A colorless to slightly yellow, clear, effervescent liquid, having a sweet, acidulous taste, and a lemon flavor.
Action and Uses: Laxative and cathartic.
Dosage: 200 cc.
Formula: Dissolve 33 Gm. of citric acid in 150 cc. of hot distilled water and add 15 Gm. of magnesium carbonate previously mixed with 100 cc. of distilled water; stir it until solution is complete. Then add 60 cc. of syrup, heat the mixed liquids to the boiling point and immediately add 0.1 cc. of oil of lemon previously triturated with 5 Gm. of purified talc and filter the mixture while hot into a strong, sterilized bottle. Add enough distilled water to make 350 cc. When cool, add 2.5 Gm. of potassium bicarbonate and immediately stopper the bottle securely.
Evidence of Deterioration: A crystalline deposit, a fungus growth, or a lack of effervescence.
Storage: In tight containers, on their sides, in a cool place.

SOLUTION OF SODIUM HYPOCHLORITE, *sodii hypochloritis, liquor,* U.S.P.
A clear, pale greenish yellow liquid, having the odor of chlorine. It is affected by light. It contains about 5 percent NaOCl.
Caution: This solution is not suitable for application to wounds.
Incompatibilities: Acids decompose it, liberating chlorine.
Action and Uses: In the form of the dilute solution, it is used as an antiseptic and germicide.
Preparations: Diluted solution of sodium hypochlorite, *liquor sodii hypochloritis dilutus,* N.F. (modified Dakin's solution). It contains about 0.5 percent of NaOCl.
Evidence of Deterioration: A product having little or no color.
Storage: In tight, light-resistant containers, in a cool place.

SPIRIT OF GLYCERYL TRINITRATE, *glycerylis trinitratis, spiritus,* U.S.P. (spirit of nitroglycerin, spirit of trinitrin, spirit of glonoin).
A clear, colorless liquid, having the odor of alcohol, containing 1 percent of nitroglycerin. **Caution:** *It should not be tasted,* since even a small quantity is likely to produce a violent headache. The same effect is produced when it is applied to the skin.
Caution: Great care must be exercised in dispensing, handling, packing, transporting, and storing this preparation, as a dangerous explosion may result if any considerable quantity is spilled, and the alcohol wholly or partly lost by evaporation. If, through accident, it is spilled, a solution of potassium or sodium hydroxide should be poured over it at once to decompose the glyceryl trinitrate.
Action and Uses: Vasodilator. Prevents and relieves attacks of angina pectoris.
Dosage: 0.06 cc.
Preparations: Glyceryl trinitrate tablets, *tabellae glycerylis trinitratis,* U.S.P. (nitroglycerin tablets, trinitrin tablets) 0.3 mg., 0.4 mg., 0.6 mg., 1.2 mg.
Storage: In tight, light-resistant containers.

STARCH, *amylum,* U.S.P. (corn starch)
A fine, white powder.
Solubility: Insoluble in cold water, and in alcohol. Partially soluble in hot water, forming a jelly on cooling.
Action and Uses: Demulcent. It is used as a dusting powder, in enemata and, when boiled with water and glycerin, as an emollient and protective.
Preparations: Glycerite of starch, *glyceritum amyli,* U.S.P.
A smooth mixture of 10 Gm. of starch, 0.2 Gm. of benzoic acid, 20 cc. distilled water, and 70 cc. of glycerin, is heated at a temperature not exceeding 144° C., with constant stirring, until a translucent, jelly-like mass results.
Storage: In well-closed containers.

STROPHANTHIN, *strophanthinum,* U.S.P.
A white or yellowish powder.
Caution: It is extremely poisonous.
Solubility: Soluble in water and in diluted alcohol.

Action and Uses: Much like digitalis, used as a cardiac stimulant.
Dosage: Intravenous, 0.5 mg.
Preparations: Strophanthin injection, *injectio strophanthini,* U.S.P. Dose: 0.5 mg.
Storage: In tight, light-resistant containers.

STRYCHNINE SULFATE, *strychninae sulfas,* U.S.P.
Colorless or white crystals, or a white, crystalline powder, without odor. It is efflorescent in dry air.
Caution: It is extremely poisonous.
Solubility: Soluble in water (35), in alcohol (85), in chloroform (220), freely soluble in glycerin, and insoluble in ether.
Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Stimulates the spinal cord and, in overdosage, causes convulsions. In small doses, a bitter tonic. A physiological antidote in barbiturate poisoning. Its use in medicine has greatly declined.
Dosage: 0.002 Gm.
Preparations: Strychnine sulfate tablets, *tabellae strychninae sulfatis,* U.S.P.
Evidence of Deterioration: Effloresced crystals.
Storage: In tight, light-resistant containers.

SUBLIMED SULFUR, *sulfur sublimatum,* U.S.P. (flowers of sulfur)
A fine, yellow, crystalline powder, having a faint odor and taste.
Solubility: Practically insoluble in water, and nearly insoluble in alcohol. It is soluble in olive oil (100).
Action and Uses: Antiseptic and antiparasitic. Formerly used as a laxative.
Dosage: 4 Gm.
Preparations: Alkaline sulfur ointment, *unguentum sulfuris alkalinum,* N.F.
Rub 20 Gm. of sublimed sulfur with 10 Gm. of potassium carbonate until a smooth, homogeneous mixture results; incorporate 4 Gm. of wool fat with this mixture; then add a mixture of 4 Gm. of yellow wax and 57 Gm. of petrolatum, previously melted and cooled, and mix thoroughly.
Compound ointment of Sulfur, *unguentum sulfuris compositus,* N.F. (Wilkinson's Ointment, Hebra's Itch Ointment). Melt 30 Gm. of solid petroxolin with 30 Gm. of soft soap and add 15 Gm. of juniper tar, then incorporate by trituration 15 Gm. of sublimed sulfur and 10 Gm. of precipitated calcium carbonate, added in several portions, and rub the ointment until it is smooth.
Storage: In well-closed containers.

SUCCINYLSULFATHIAZOLE, *succinylsulfathiazolum,* U.S.P.
A white or yellowish white, crystalline powder. It is stable in air, but slowly darkens on exposure to light.
Solubility: Soluble in water (4800); sparingly soluble in alcohol.
Action and Uses: Poorly absorbed from the gastrointestinal tract where it slowly liberates sulfathiazole, this sulfonamide is used to combat intestinal infection, especially bacillary dysentery.
Dosage: 2 Gm.
Preparations: Succinylsulfathiazole tablets, *tabellae succinylsulfathiazolum,* U.S.P. Dose: 2 Gm.
Evidence of Deterioration: A darkened product.
Storage: In well-closed, light-resistant containers.

SUCROSE, *sucrosum,* U.S.P. (sugar, saccharum)
Colorless or white crystals, crystalline masses or blocks, or a white, crystalline powder. It is odorless, has a sweet taste, and is stable in dry air.
Solubility: Soluble in water (0.5) and in alcohol (170).
Action and Uses: Sweetening agent and dietary adjunct.
Preparations: Syrup, *syrupus,* U.S.P. (simple syrup, sirup) sucrose, 850 Gm., dissolved in sufficient distilled water to make 1000 cc.
Evidence of Deterioration: A caked product.
Storage: In well-closed containers.

SULFADIAZINE, *sulfadiazinum,* U.S.P.
Odorless, white or slightly yellow crystalline powder.
Solubility: Nearly insoluble in water (13,000); readily soluble in dilute mineral acids and in alkaline solutions; sparingly soluble in alcohol and in acetone; insoluble in ether and in chloroform.
Action and Uses: Used chiefly in the treatment of pneumococcic pneumonia, hemolytic streptococcic infections, staphylococcic infections, meningitis, and urinary

tract infections due to gram-negative organisms. To avoid the complications caused by crystallizations in the urine, the drug should be given with large amounts of sodium bicarbonate and the patient should receive at least 1500 cc. of fluid per day.

Dosage: In severe infections the initial dose is based on 0.10 Gm. per kilogram (2.2 lb.) of body weight with subsequent doses of 1.0 to 1.5 Gm. every four hours. In mild or moderate infections, the initial dose is 0.05 Gm. per kilogram of body weight followed by one-third of the initial dose every 4 hours. The U.S.P. dose is 2 Gm.

Preparations: Tablets of sulfadiazine, *tabellae sulfadiazini, U.S.P.* Usually available containing either 0.3 Gm. or 0.5 Gm.

Evidence of Deterioration: Discoloration.

Storage: In well-closed, light-resistant containers.

SULFADIAZINE SODIUM, *sulfadiazinum sodicum,* U.S.P.

A white powder. On prolonged exposure to humid air, it absorbs carbon dioxide with the liberation of sulfadiazine and becomes incompletely soluble in water. It is affected by light.

Solubility: Soluble in water (2); slightly soluble in alcohol.

Incompatibilities: Acids decompose it.

Action and Uses: Similar to those of sulfadiazine. The sodium salt may be given intravenously as a 5 percent solution and is of great value when rapid effects are essential or when oral administration is impossible. Solutions for intravenous injection are made up in sterile distilled water, they should not be boiled.

Dosage: 2 Gm., as a 5 percent solution.

Evidence of Deterioration: A product incompletely soluble in water.

Storage: In tight, light-resistant containers.

SULFAGUANIDINE, *sulfaguanidinum,* U.S.P.

A white, crystalline powder.

Solubility: Slightly soluble in water (1000); sparingly soluble in alcohol; freely soluble in dilute mineral acids; insoluble in solutions of sodium hydroxide.

Action and Uses: Poorly absorbed from the gastrointestinal tract, it is used in bacillary dysentery and as a prophylactic agent in colonic surgery.

Dosage: In bacillary dysentery the initial dose by mouth is 0.05 Gm. per kilogram (2.2 lb.) of body weight, followed by a maintenance dose of the same quantity every 4 hours day and night until the number of stools is less than six daily; then the same quantity every 8 hours for 3 days. The prophylactic dosage in colonic surgery is 0.05 Gm. per kilogram of body weight every 8 hours for 5 days and nights before the operation and for 7 days after the operation.

Preparations: Sulfaguanidine tablets, *tabellae sulfaguanidini,* U.S.P. 0.5 Gm.

Evidence of Deterioration: Darkening due to exposure to strong light.

Storage: In well-closed, light-resistant containers.

SULFANILAMIDE, *sulfanilamidum,* U.S.P.

White crystals, granules, or powder.

Solubility: Soluble in water (125), in alcohol (37), and in acetone (5). It is very soluble in boiling water.

Action and Uses: It is used in the treatment of infections due to several organisms, among them hemolytic streptococcus, meningococcus and gonococcus. It is used orally, topically, and parenterally. Except for its local use, it has been displaced by other sulfonamides for most purposes.

Dosage: Depends on the type and severity of the infection.

Preparations: Sulfanilamide tablets, *tabellae sulfanilamidi,* U.S.P. 0.5 Gm.

Storage: In well-closed, light-resistant containers.

SULFAPYRIDINE, *sulfapyridinum,* U.S.P.

White or faintly yellowish-white crystals, granules or powder. It is odorless or nearly so, and is stable in air, but slowly darkens on exposure to light.

Caution: Daily complete blood counts and urinalysis are imperative. Should be used only under the close supervision of a physician.

Solubility: Soluble in water (3500), in alcohol (440) and in acetone (65).

Action and Uses: Used in pneumococcic pneumonia, in other pneumococcic infections, and in gonorrhea. Causes more nausea than other sulfonamides, and its use is declining.

Dosage: For adults suffering from pneumonia, initial doses up to 4 Gm. in a single dose, followed by 1 Gm. every four hours until temperature has been normal for 72 hours.

Preparations: Sulfapyridine tablets, *tabellae sulfapyridini,* U.S.P. 0.5 Gm.
Evidence of Deterioration: Darkening in color.
Storage: In well-closed, light-resistant containers.

SULFARSPHENAMINE, *sulfarsphenamina,* U.S.P.
A yellow powder. It is slowly oxidized by exposure to air, becoming dark and more toxic.
Solubility: Very soluble in water; slightly soluble in alcohol.
Action and Uses: Antisyphilitic which may be used intramuscularly. Because of the frequency of untoward reactions its use is declining.
Dosage: Intramuscular, 0.45 Gm.
Evidence of Deterioration: A darkened product.
Storage: In sealed tubes, from which the air has been excluded, at a temperature not above 20° C.

SULFATHIAZOLE, *sulfathiazolum,* U.S.P.
White or faintly yellowish-white crystals, granules, or powder. It is odorless or nearly so, and is stable in air, but slowly darkens on exposure to light.
Solubility: Soluble in water (1700), in alcohol (200), and soluble in acetone.
Action and Uses: Used in the treatment of various diseases especially those caused by pneumococci, gonococci, Friedländer's bacilli and staphylococci. The danger of renal complications necessitates that the patient's fluid intake be kept high and that large amounts of sodium bicarbonate be given.
Dosage: In the treatment of pneumococcic pneumonia in adults the initial dose is 4 Gm. followed by 1 Gm. every four hours until the temperature has been normal for 72 hours. In the treatment of gonorrhea the first day's dose is 3 Gm. and then 2 Gm. for the following 9 days.
Preparations: Sulfathiazole tablets, *tabellae sulfathiazoli,* U.S.P. 0.5 Gm.
Evidence of Deterioration: Darkening in color.
Storage: In well-closed, light-resistant containers.

SULFATHIAZOLE SODIUM, *sulfathiazolum sodicum,* U.S.P.
A white to faintly yellowish white powder. On prolonged exposure to humid air, it absorbs carbon dioxide with the liberation of sulfathiazole and becomes incompletely soluble in water. It is affected by light.
Solubility: Soluble in water (2.5) and in alcohol (15).
Incompatibilities: Acids decompose it.
Action and Uses: Similar to those of sulfathiazole. This sodium salt may be given intravenously in 5 percent solution. Such solutions should be made with sterile distilled water and they should not be boiled.
Dosage: 2 Gm., in 5 percent solution.
Evidence of Deterioration: A product incompletely soluble in water.
Storage: In tight, light-resistant containers.

SULFURIC ACID, *acidum sulfuricum,* U.S.P. (oil of vitriol)
A colorless, odorless, oily liquid containing about 96 percent of H_2SO_4.
Caution: Very caustic and corrosive. When sulfuric acid is mixed with other liquids, it should always be added to the diluent, and great caution should be observed. When diluting sulfuric acid, vessels capable of withstanding heat should be used.
Solubility: Miscible with water and with alcohol with the evolution of much heat.
Sp. Gr.: 1.84 Boils: About 290° C.
Incompatibilities: In addition to having the usual incompatibilities common to most acids, it chars certain organic materials.
Action and Uses: Caustic and corrosive. It is used in modern medicine only in diluted forms, and seldom, if at all, employed as a medicament.
Preparations. Aromatic sulfuric acid, *acidum sulfuricum aromaticum,* U.S.P. XI (elixir of vitriol). Prepared by adding 114 cc. of sulfuric acid gradually, and with great caution, to 700 cc. of alcohol, then adding 10 cc. of fluidextract of ginger, 1 cc. of oil of cinnamon and sufficient alcohol to make 1000 cc. Dose: 0.5 cc.
Diluted sulfuric acid, *acidum sulfuricum dilutum,* U.S.P. Prepared by adding 57 cc. of sulfuric acid to sufficient distilled water to make 1000 cc.
Caution: Add the acid slowly and with constant stirring to the distilled water contained in a vessel capable of withstanding great heat. Dose: 1 cc., well-diluted.
Storage: In tight containers.

TANNIC ACID, *acidum tannicum,* U.S.P. (gallotannic acid, tannin) An amorphous powder or glistening scales (fluffy) varying in color from yellowish-white to light brown. It is odorless or has a faint characteristic odor and a strong astringent taste.

Caution: When it is to be dissolved, the fluffy variety is preferred.
Solubility: Very soluble in water, in alcohol and in acetone. Soluble in warm glycerin (1).
Incompatibilities: Alkaloids are precipitated as insoluble alkaloidal tannates. Soluble iron compounds form iron tannate, a soluble compound, the color of which resembles that of ink. Gelatin and albumin are precipitated. It is incompatible with nearly all of the salts of the heavy metals.
Action and Uses: Astringent. Antidote for many alkaloidal and metallic poisons. Formerly much used locally in the treatment of burns, but other methods are now preferred.
Dosage: 0.5 Gm.
Preparations: Glycerite of tannic acid, *glyceritum acidi tannici,* U.S.P. Mix 20 Gm. of tannic acid, 1 Gm. of sodium citrate, and 0.2 Gm. of exsiccated sodium sulfite, with 78.8 Gm. of glycerin, and heat at a temperature between 115° and 120° C. until solution is complete.
Tannic Acid Ointment, *unguentum acidi tannici,* U.S.P. Dissolve 20 Gm. of tannic acid and 0.2 Gm. exsiccated sodium sulfite in 20 Gm. of glycerin, with the aid of gentle heat, and incorporate the solution with 59.8 Gm. of yellow ointment.
Styptic collodion, *collodium stypticum,* N.F. Prepared by dissolving 16 Gm. of tannic acid in sufficient flexible collodion to make 100 cc.
Caution: During its manufacture and storage this ointment must not come in contact with iron utensils or containers.
Evidence of Deterioration: It darkens on exposure to light.
Storage: In tight, light-resistant containers.

TARTARIC ACID, *acidum tartaricum,* U.S.P.
Colorless or translucent crystals or a white powder. It is odorless and has an acid taste.
Solubility: Soluble in water (0.8) and in alcohol (3).
Incompatibilities: Carbonates and bicarbonates are decomposed by it.
Action and Uses: Used in the preparation of Seidlitz powders and effervescent salts.
Dosage: 1 Gm.
Storage: In well-closed containers.

TERPIN HYDRATE, *terpini hydras,* U.S.P.
Colorless, lustrous crystals, or a white powder. It is efflorescent in dry air.
Solubility: Soluble in water (200), in alcohol (13), and in chloroform (140).
Incompatibilities: Owing to its limited solubility in water, it may be precipitated when elixir of terpin hydrate is diluted with aqueous preparations.
Action and Uses: Considered an expectorant.
Dosage: 0.25 Gm.
Preparations: Elixir of terpin hydrate, *elixir terpini hydratis,* N.F.
Dissolve 17 Gm. of terpin hydrate in 425 cc. of alcohol; add successively 20 cc. of tincture of sweet orange peel, 5 cc. of spirit of benzaldehyde, 400 cc. of glycerin, 100 cc. of syrup, with sufficient distilled water to make 1000 cc. Filter. Dose: 4 cc.
Evidence of Deterioration: An effloresced product.
Storage: In tight containers.

TETANUS ANTITOXIN, *antitoxinum tetanicum,* U.S.P. (purified antitetanic serum, concentrated tetanus antitoxin, refined tetanus antitoxin, antitetanic globulins). A sterile, aqueous solution of antitoxic substances obtained from the blood serum or plasma of a healthy animal which has been immunized against tetanus toxin. It has a potency of not less than 400 antitoxic units per cc.
Action and Uses: Curative and prophylactic agent in tetanus.
Dosage: By parenteral injection: Therapeutic, 20,000 units; prophylactic, 1500 units.
Storage: Preserve at a temperature between 2° and 10° C., preferably at the lower limit. It must be dispensed in the unopened glass container in which it was placed by the manufacturer.

TETANUS TOXOID, *toxoidum tetanicum,* U.S.P.
Action and Uses: Used to produce active immunity to tetanus.
Dosage: Subcutaneous, 1 cc.; repeated at proper intervals.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

TETRACAINE HYDROCHLORIDE, U.S.P.; *tetracainae hydrochloridum*
A fine, white, crystalline powder.
Solubility: Very soluble in water; soluble in alcohol.

Incompatibilities: Alkalies and iodine precipitate it.
Action and Uses: Local and spinal anesthetic.
Dosage: For spinal anesthesia, 10 to 20 mg. For local application, 0.5 percent to 2 percent aqueous solutions.
Storage: In well-closed containers.

TETRACHLOROETHYLENE, *tetrachloroaethylenum,* U.S.P. (perchloroethylene, ethylene tetrachloride)
A clear, colorless, mobile liquid, having a characteristic ethereal odor. It is not inflammable. It is slowly decomposed by light and various metals in the presence of moisture.
Solubility: Practically insoluble in water; miscible with an equal volume of alcohol, with ether, chloroform, petroleum benzin, and benzene.
Action and Uses: Anthelmintic, particularly for the hookworm.
Dosage: 3 cc.
Preparations: Tetrachloroethylene capsules, *capsulae tetrachloroaethyleni,* U.S.P., 0.2 cc., 1.0 cc., and 2.5 cc.
Storage: In tight, light-resistant containers.

THEOBROMA OIL, *oleum theobromatis,* U.S.P. (cocoa butter)
A pale yellow, solid fat, brittle at temperatures below 25° C.
Solubility: Slightly soluble in alcohol; freely soluble in ether and in chloroform.
Melts: Between 30° and 35° C.
Incompatibilities: Chloral hydrate, phenol, salol, and camphor when mixed with it form masses of lower melting point. This must be overcome in preparing suppositories of one or more of these substances when the vehicle is theobroma oil.
Action and Uses: Emollient and lubricant. Its principal use is as a vehicle for suppositories.
Evidence of Deterioration: Porous white coating.
Storage: In well-closed containers, away from excessive heat.

THEOBROMINE WITH SODIUM SALICYLATE, *theobromina cum sodii salicylate,* N.F.
A white, odorless powder having a sweetish, saline, and somewhat alkaline taste.
Solubility: Soluble in water (1); slightly soluble in alcohol.
Action and Uses: A myocardial stimulant and diuretic.
Preparations: Tablets.
Dosage: 1 Gm.
Storage: In tight containers.

THEOCALCIN, N.N.R.
A white, amorphous powder, chemically a double salt or a mixture of calcium theobromine and calcium salicylate.
Solubility: Incompletely soluble in water.
Incompatibilities: Acids decompose it.
Action and Uses: Diuretic, used especially in cardiac edema.
Dosage: 0.5 Gm.
Storage: In well-closed containers.

THEOPHYLLINE ETHYLENEDIAMINE, *theophyllina aethylenediaminica,* U.S.P. (aminophylline)
White or yellowish-white granules with a slight, ammoniacal odor and a bitter taste.
Solubility: Soluble in water (5); insoluble in alcohol and in ether.
Action and Uses: Diuretic, commonly used in the treatment of cardiac disease. Given intravenously, effective in the relief of asthmatic attacks and paroxysmal cardiac dyspnea.
Dosage: 0.2 Gm.
Preparations: Theophylline ethylenediamine injection, *injectio theophyllinae aethylenediaminicae,* U.S.P. Dose: Intramuscular or intravenous, 0.1 Gm.
Theophylline ethylenediamine tablets, *tabellae theophyllinae aethylenediaminicae,* U.S.P. 0.1 Gm. and 0.2 Gm., enteric coated.
Evidence of Deterioration: Turbidity of solutions due to exposure to carbon dioxide and precipitation of theophylline.
Storage: In tight containers.

THIAMINE HYDROCHLORIDE, *thiaminae hydrochloridum,* U.S.P (vitamin B_1)
Small, white crystals or a crystalline powder, having a slight, characteristic odor.
Solubility: Soluble in water (1) and in alcohol (100).

Action and Uses: In the treatment and prevention of beriberi and in conditions indicating interference with proper assimilation of the vitamins.
Dosage: 5 mg.
Preparations: Thiamine hydrochloride tablets, *tabellae thiaminae hydrochloridi,* U.S.P. (vitamin B_1 tablets) Usually available as follows: 0.3 mg., 1 mg., 3 mg., 5 mg., 6 mg., 9 mg., 10 mg., and 12 mg.
Storage: In tight, light-resistant containers.

THYMOL, *thymol,* U.S.P.
Colorless crystals, or a white, crystalline powder. It has an aromatic, thyme-like odor, and a pungent taste.
Solubility: Soluble in water (1000), in alcohol (1), in chloroform (1), in ether (1.5), and in fixed and volatile oils.
Incompatibilities: It liquefies when placed in contact with phenol, menthol, camphor, salol, and similar substances.
Action and Uses: Antiseptic and anthelmintic.
Dosage: Anthelmintic, 2 Gm., divided into three doses.
Storage: In tight, light-resistant containers.

THYMOL IODIDE, *thymolis iodidum,* U.S.P.
A reddish-brown or reddish-yellow, bulky powder with a characteristic, aromatic odor.
Solubility: Insoluble in water and in glycerin; slightly soluble in alcohol; readily soluble in chloroform, in ether, in collodion, and in fixed and volatile oils, usually leaving a slight residue.
Action and Uses: Antiseptic.
Storage: In tight, light-resistant containers.

THYROID, *thyroideum,* U.S.P.
A yellowish to buff colored, amorphous powder, having a slight, characteristic, meat-like odor and a saline taste.
Action and Uses: Used in thyroid deficiency.
Dosage: 0.06 Gm.
Preparations: Thyroid tablets, *tabellae thyroidei,* U.S.P.
Storage: In tight containers, at a temperature not above 30° C.

TOLU BALSAM, *balsamum tolutanum,* U.S.P. (tolu, balsam of tolu) A brown or yellowish-brown, plastic solid, having an odor resembling vanilla.
Solubility: Nearly insoluble in water; soluble in alcohol, in chloroform, and in ether.
Action and Uses: It is used chiefly in the form of the syrup as a vehicle.
Preparations: Syrup of tolu balsam, *syrupus balsami tolutani,* U.S.P. (syrup of tolu) Mix 50 cc. of tincture of tolu balsam with 10 Gm. of magnesium carbonate and 60 Gm. of sucrose, add 430 cc. of distilled water and filter. Dissolve 760 Gm. of sucrose in the filtrate with gentle heating, strain, and add sufficient distilled water to make 1000 cc.
Tincture of tolu balsam, *tinctura balsami tolutani,* U.S.P. (tolu tincture) Macerate 200 Gm. of tolu balsam with 750 cc. of alcohol for three days, with frequent agitation; filter, and add sufficient alcohol through the filter to make 1000 cc.
Storage: In tight containers, avoiding exposure to excessive heat.

TRIBROMOETHANOL, *tribromoaethanol,* U.S.P.
A white, crystalline powder, with slight, aromatic odor and taste, unstable in air.
Solubility: In water (35); soluble in amylene hydrate.
Action and Uses: A basal anesthetic, administered rectally.
Dosage: The ordinary dose for basal anesthesia is 80 mg. per kilogram of body weight. It is used in the form of a solution in amylene hydrate.
Storage: In tight, light-resistant containers.

TRICHLOROACETIC ACID, *acidum trichloroaceticum,* U.S.P.
Colorless, deliquescent crystals having a slight, characteristic odor.
Caution: Extremely caustic. Handle with great care because it rapidly destroys tissue.
Solubility: Very soluble in water (0.1), and in alcohol and ether.
Melts: 57° to 58° C.
Action and Uses: Caustic, escharotic, astringent, hemostatic. Used for removal of warts and corns. Used in dentistry to destroy hypertrophies.
Evidence of Deterioration: A liquefied or partially liquefied product indicates absorption of water, with corresponding reduction in percentage strength.
Storage: In tight containers, at a temperature not above 30° C.

TRINITROPHENOL, *trinitrophenol,* U.S.P. (picric acid)
Pale yellow prisms or scales. It is odorless, and has an intensely bitter taste.
Caution: Explodes when heated rapidly or when subjected to percussion.
Solubility: Soluble in water (80), in alcohol (12), in chloroform (35), and in ether (65).
Incompatibilities: Oxidizable substances decompose it.
Action and Uses: Antiseptic. Its aqueous solution formerly was used in the treatment of superficial burns.
Storage: In well-closed containers, avoiding exposure to excessive heat.

TRYPARSAMIDE, *tryparsamidum,* U.S.P.
A white, odorless, crystalline powder, a pentavalent arsenic compound, affected by light.
Solubility: Soluble in water (2), slightly soluble in alcohol, and insoluble in ether and in chloroform.
Action and Uses: Used in neurosyphilis, especially early paresis; and in trypanosomiasis.
Dosage: Caution: Intravenous, 2 Gm. It should never be given by mouth.
Storage: In tight, light-resistant containers, at a temperature not above 20° C.

TUBERCULIN, OLD, *tuberculinum pristinum,* U.S.P. (tuberculin-Koch, concentrated tuberculin, crude tuberculin)
Action and Uses: Used chiefly for the diagnosis of tuberculosis.
Dosage: Diagnostic, intracutaneous, 0.000,01 cc. to 0.001 cc. Therapeutic, subcutaneous, 0.000,000,01 cc. to 0.000,001 cc.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

TYPHOID VACCINE, *vaccinum typhosum,* bacterial vaccine made from the typhoid bacillus, U.S.P. (typhoid prophylactic, enteric vaccine).
Action and Uses: Used for establishing immunity to typhoid fever.
Dosage: Prophylactic, hypodermic, 0.5 cc. and 1 cc., the latter dose to be repeated once.
Storage: At a temperature between 2° and 10° C., preferably at the lower limit.

WATER, *aqua,* U.S.P.
A clear, colorless liquid which is practically tasteless and odorless.
Preparations: Distilled water, *aqua destillata,* U.S.P. Water purified by distillation.
Sterilized distilled water, *aqua destillata sterilisata,* U.S.P., distilled water which has been sterilized by one of the official methods.
Water for injection, *aqua pro injectione,* U.S.P. Water which has been distilled and sterilized within 24 hours. It is free from pyrogens.
Storage: Preserve sterilized distilled water in the container in which it was sterilized, and protect from contamination.
Caution: When "sterile water" or "sterile distilled water" for parenteral use is required, "water for injection" must be dispensed.

WHISKY, *spiritus frumenti,* U.S.P. (whiskey)
A light to deep amber-colored liquid having a characteristic odor and taste, and an acid reaction.
Sp. Gr.: 0.930.
Action and Uses: Its action depends upon the alcohol that it contains.
Storage: In tight containers.

WHITE WAX, *cera alba,* U.S.P. (bleached beeswax)
A yellowish-white solid, somewhat translucent in thin layers. It has a faint, characteristic odor, is free from rancidity, and is nearly tasteless.
Action and Uses: Used in the manufacture of pharmaceutical preparations.
Storage: In well-closed containers.

WOOL FAT, *adeps lanae,* U.S.P. (anhydrous wool fat, anhydrous lanolin)
A brownish yellow, tenacious, unctuous mass, having not more than a slight odor.
Solubility: It is insoluble in water, but mixes without separation with about twice its weight of water. It is sparingly soluble in cold alcohol; more soluble in hot alcohol; and freely soluble in ether and in chloroform.
Melting Point: 36° to 42° C.
Incompatibilities: Its melting point is lowered upon admixture with camphor, menthol, phenol, thymol, and chloral hydrate.

Action and Uses: A base for ointments.
Preparations: Hydrous wool fat, *adeps lanae hydrosus,* U.S.P. (hydrous lanolin, lanolin). Wool fat containing not less than 25 percent and not more than 30 percent of water.
Storage: In well-closed containers, in a cool place.

ZEPHIRAN CHLORIDE, N.N.R.
Colorless or slightly yellow, gelatinous material, possessing an aromatic odor and a very bitter taste. Chemically a mixture of alkyl dimethyl benzyl ammonium chlorides.
Solubility: Miscible in all proportions with water, alcohol and acetone.
Incompatibilities: Solutions of soap may reduce the germicidal activity.
Action and Uses: Disinfectant and germicide.
Dosage: For topical application, in 1–10,000 to 1–2000 solutions.
Storage: In well-closed containers.

ZINC CHLORIDE, *zinci chloridum,* U.S.P.
A white or nearly white, odorless, crystalline powder, or porcelain-like masses, or moulded pencils. It is very deliquescent.
Solubility: Soluble in water (0.5), in alcohol (1.5), and in glycerin (2). Its solution in water or in alcohol is usually slightly turbid, but the turbidity disappears upon the addition of a very small quantity of hydrochloric acid.
Incompatibilities: Alkalies precipitate it.
Action and Uses: Antiseptic, astringent and escharotic.
Dosage: In collyria, not stronger than 0.4 percent solution.
Evidence of Deterioration: A deliquesced product.
Storage: In tight containers.

ZINC OXIDE, *zinci oxidum,* U.S.P.
A very fine, odorless, amorphous, white or yellowish-white powder, free from gritty particles.
Solubility: Insoluble in water and in alcohol; dissolves in dilute acids.
Action and Uses: Antiseptic, astringent, and protective.
Preparations: Paste of zinc oxide, *pasta zinci oxidi,* N.F. (Lassar's plain zinc paste). Mix 25 Gm. of zinc oxide and 25 Gm. of starch with 50 Gm. of white petrolatum. Zinc oxide ointment, *unguentum zinci oxidi,* U.S.P. (zinc ointment). Levigate 20 Gm. of zinc oxide with 7 Gm. of wool fat and incorporate the mixture with 73 Gm. of white ointment.
Storage: In well-closed containers.

ZINC PEROXIDE, MEDICINAL, *zinci peroxidum medicinale,* U.S.P.
A fine, white or only faintly yellow, odorless powder.
Solubility: Insoluble in water and in alcohol.
Incompatibilities: Water and acids cause decomposition.
Action and Uses: Used in the treatment of certain wound infections, usually in the form of a freshly prepared aqueous suspension.
Preparations: Sterilized medicinal zinc peroxide, *zinci peroxidum medicinale sterilisatum,* U.S.P. The powder is sterilized in small quantities by heating it in a dry oven for four hours at 140° C.
Storage: In tight containers.

ZINC STEARATE, *zinci stearas,* U.S.P.
A fine, white, bulky powder, free from grittiness. It has a faint, characteristic odor.
Solubility: Insoluble in ordinary solvents; very repellent to water.
Action and Uses: Antiseptic, astringent, and protective. Used chiefly as a dusting powder to prevent and treat chafing.
Preparations: Ointment of zinc stearate, *unguentum zinci stearatis,* N.F. Melt 55 Gm. of white petrolatum, add 10 Gm. of liquid petrolatum and, when the mixture has congealed, incorporate 35 Gm. of zinc stearate.
Storage: In well-closed containers.

ZINC SULFATE, *zinci sulfas,* U.S.P. (white vitriol)
Colorless, transparent prisms, or small needles, or a granular, crystalline powder. It is efflorescent in dry air.
Caution: An effloresced product should not be used in preparing collyria or reagents.
Incompatibilities: Alkalies precipitate it.
Action and Uses: Astringent, styptic and emetic.

Dosage: Emetic, 1 Gm. In collyria usually 0.1 to 0.2 percent, seldom above 0.5 percent.

Preparations: Compound powder of zinc sulfate, *pulvis zinci sulfatis compositus,* N.F. (*pulvis antisepticus*) Triturate 5 Gm. of salicylic acid and 125 Gm. of zinc sulfate to a fine powder and add 1 Gm. each of phenol, eucalyptol, menthol, and thymol, previously liquefied by trituration. Add 866 Gm. of boric acid and pass the powder through a very fine sieve.

Evidence of Deterioration: An effloresced product.

Storage: In tight containers.

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